



*Direct Push Groundwater Sampling at BH119, Between Blackfoot River Road and the Blackfoot River*

## **P4 PRODUCTION**

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### **DIRECT PUSH GROUNDWATER CONTINUATION SAMPLING AND ANALYSIS PLAN**

**FINAL  
Revision 2**

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**June 2009**

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## P<sub>4</sub> Production, LLC

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June 15, 2009

Mr. Mike Rowe  
IDEQ  
444 Hospital Way, #300  
Pocatello, ID 83202

**RE: Revision 2 – Draft 2009 Direct Push Groundwater Continuation Sampling and Analysis Plan** *BSK*


Dear Mr. Rowe,

Enclosed is Revision 2 of the 2009 Direct Push Groundwater Continuation Sampling and Analysis Plan (SAP), which represents the final version pending the Agencies and Tribes (A/T's) approval. This revision incorporates resolutions to all comments including the resolution presented by the A/T's on June 4, 2009 relating to the DELB value. All comments and comment responses for the SAP are attached to the end of the document.

To help facilitate an expedient review of this revision, the text additions and revisions relating to the recent May 8, 2009 comments sent and the June 4, 2009 correspondence are underlined in the document. The text deletions have not been highlighted. The deletions were generally replaced by new text or were minor changes.

If you have any questions, please do not hesitate to contact me at (208) 547-1439.

Sincerely,



Barry Koch  
Special Projects Lead - Mining

**CC:**

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**DIRECT PUSH GROUNDWATER CONTINUATION  
SAMPLING AND ANALYSIS PLAN**

**FINAL  
Revision 2**

**P4 PRODUCTION**

*June 2009*

This Sampling and Analysis Plan (SAP) describes continued environmental investigation activities and procedures, which P4 Production (P4) will use to conduct 2009 direct push investigations at Ballard, Henry, and Enoch Valley Mines. The SAP is organized into three parts:

- Part 1—Program Quality Assurance Plan (QAPP) and QAPP Addendum
- Part 2—Field Sampling Plan (FSP)
- Part 3—Agencies and Tribes Comments and P4 Comment Responses

The FSP references a brief program background and summarizes the objectives, sample collection, handling, analysis, and methods of the 2009 direct push investigation. The FSP also contains drawings, which show direct push sample locations and standard operating procedures (SOPs) for obtaining quality samples.

The FSP is designed to be used in conjunction with the QAPP and addendum to ensure sample and laboratory analytical quality.

The QAPP describes program-specific data requirements for the measurement of field parameters and sample collection for laboratory analysis. It also presents quality assurance (QA) and quality control (QC) procedures to assure that the data are precise, accurate, representative, comparable, and complete.

The SAP will serve as the guidance manuals for the 2009 direct push investigation field efforts. Therefore, the team will have a copy of this document at all times when in the field.

**PART 1 - QUALITY ASSURANCE PROJECT PLAN (QAPP)  
AND QAPP ADDENDUM**

## **QUALITY ASSURANCE PROJECT PLAN (QAPP) AND QAPP ADDENDUM**

P4 is incorporating, by reference, the program QAPP and Final QAPP addendum (MWH, 2004 and MWH, 2009) for the 2009 direct push continuation. These documents specify program management, measurement and data acquisition, and assessment oversight.

Briefly, the analytical parameter for the 2009 direct push investigation is dissolved selenium. The analytical laboratory (Microbac) will use EPA Method 6020A to analyze for dissolved selenium. The reporting limit is 0.001 mg/L and the method detection limit is 0.0005 mg/L for this method. See table 2-6 in MWH (2009) for more information.

### **REFERENCES:**

MWH, 2004. *Comprehensive Site Investigation Program Quality Assurance Plan—Final*. Prepared by MWH. April 2004.

MWH, 2009. *Final Quality Assurance Project Plan Addendum Program Quality Assurance Plan*. Prepared by MWH. May 2009.

## **PART 2 – FIELD SAMPLING PLAN**

**DIRECT-PUSH GROUNDWATER CONTINUATION  
FIELD SAMPLING PLAN**

**FINAL  
Revision 2**

**P4 PRODUCTION**

*June 2009*

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## 1.0 INTRODUCTION

This field sampling plan (FSP) documents the procedures for continued characterization of the shallow alluvium aquifer systems around Ballard, Henry, and Enoch Valley mines. The results of the 2008 direct-push investigation indicated the need for continued characterization to further evaluate and delineate the nature and extent of shallow alluvial groundwater impacts from past P4 Production (P4) mining operations (MWH, 2009). At select areas adjacent to Ballard Mine, northern Henry Mine and the western portion of Enoch Valley Mine, selenium migration extents in the shallow alluvial aquifer are not completely defined. The majority of the additional characterization needs to occur at the Ballard Mine, while the work at the Henry and Enoch Valley Mines is comparatively minor. Thus, defining the nature and extent of these areas is a data gap which will be addressed by the 2009 continuation work whereby P4 intends to satisfactorily define selenium mobilization at these three areas.

The overall groundwater investigation is being conducted in an effort to identify, characterize, and monitor groundwater flow systems associated with the potential contaminate sources at the P4 mines, with the final goal of defining risk and supporting the engineering evaluation/cost analysis (EE/CA) process. The shallow alluvial aquifer sampling will be accomplished with samples of alluvial ground water from direct-push boreholes (e.g., Geoprobe®). This sampling is designed to augment 2008 direct-push program.

This plan is structured to satisfy NCP 40CFR300.415(b)(4)(ii)(A) as well as the suggested format for a sampling and analysis plan (SAP) presented in the statement of work from the Consent Order/Administrative Order on Consent for the Performance of Site Investigations and Engineering Evaluations/Cost Analysis (EE/CAs) at P4 Production, L.L.C. Phosphate Mine Sites in Southeastern Idaho (08/20/03), EPA Docket No. CERCLA-10-2003-0117.

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## 2.0 SITE BACKGROUND

The site background for Ballard, Henry, and Enoch Valley mines is presented in detail in the 2004 project work plans for Ballard, Henry, and Enoch Valley (MWH, 2004a, MWH, 2004b, MWH, 2004c). The background information and rationale for the 2008 direct-push investigation is presented in MWH (2008a and 2008b). This document is a supplement to the 2008 direct-push investigation, and review of those documents is strongly encouraged for a complete picture of the direct-push investigation and results so far.

Detailed results of the 2008 direct-push investigation and recommended future actions are presented in MWH (2009). The 2008 program collected a large number of reconnaissance samples for selenium analysis as a primary indicator for potential contaminant impacts to the alluvial groundwater system. Reliable rapid analysis methods are not available for selenium so follow up sampling was only possible for some areas where expedited early results were obtained from locations advanced early in the program. As a result of this, further direct-push sampling is needed in 2009 to complete the investigation.

The MWH-recommended 2009 actions for direct-push are excerpted below.

The plume on the western side of the Ballard Mine is not defined in the western and southwestern directions. It is estimated that 10 to 20 direct-push sampling points will be needed to complete the definition of the western plume. The plume on the northwestern area of the Ballard Mine is largely characterized; however, it also will likely require three to five additional direct-push sampling points (MWH, 2009).

The selenium plumes on the eastern side of the Ballard Mine appear nearly defined. Approximately four additional direct-push holes are expected to be needed to complete this characterization, as well as two long-term direct-push monitoring wells (eight are proposed in this plan).

It is recommended that four to six direct-push boreholes be installed in the area between the Little Blackfoot River and waste rock dump MWD088 at the Henry Mine. In addition, following discussions with the Agencies and Tribes (A/T), two additional direct-push boreholes will be placed in the drainages east of MWD090 and upstream from MST064 and MST276.

Similarly, two to four additional direct-push boreholes should be advanced between MMW013 and the direct-push borehole BH085 to add definition to the selenium concentrations detected in the alluvial system in the southern portion of the Enoch Valley Mine.

After further evaluation of these recommendations, P4 is proposing to advance direct-push boreholes in these areas to potentially finish the nature and extent characterization in the shallow alluvial aquifers. However, this investigation is ongoing and the 2009 direct-push results will indicate whether further characterization is necessary or not. Please review Section 4.0 for the 2009 proposed locations table and map.

### 3.0 SAMPLING OBJECTIVES

The main objective for this direct-push investigation is to complete the nature and extent delineation adjacent to P4 past mining operations in the shallow alluvial aquifer.

Five remaining areas are yet to be defined to a level satisfactory for decision making. These areas are on the east and west sides of Ballard Mine, at Henry Mine near the Little Blackfoot's mine lease crossing and east of MWD090, and along the south-southwestern portion adjacent to Enoch Valley Mine's Canyon Fill Dump (MWD092).

The data quality objectives (DQOs) for this investigation remain valid. They are excerpted below from the 2008 direct-push work plan (MWH, 2008). Additions to the DQOs are italicized to reflect this additional work.

#### 3.1 Data Quality Objectives for Direct-push Groundwater Investigation

This direct-push plan was developed as a cost- and time-effective way to satisfy groundwater-related DQOs. For the convenience of the reader, these groundwater-related DQOs are summarized here.

##### Step 1 – State the Problem

- Contaminants of potential concern, primarily selenium, are leaching at concentrations of potential concern from waste rock into surface waters.
- Most of the selenium transport occurs during spring runoff and occurs from surface runoff and shallow interflow, but at least some is occurring via groundwater.
- *The extent of contamination in the shallow alluvial aquifer at each mine has not been completed.*

##### Step 2 – Identify the Goal of the Study

- *Goals of the study include characterizing the nature and extent of selenium contamination in shallow alluvium to support risk characterization, as well as understand the potential for groundwater to cause or contribute to violations of compliance thresholds in interconnected surface water. Some groundwater monitoring wells on or near Monsanto's three historic phosphate mines have selenium concentrations elevated above regional background levels (as defined by regional surface water background). Regional background water levels have not been conclusively established for groundwater or surface water, but they appear to be near the limits of quantitation. The decision is to determine whether the groundwater is elevated above the groundwater standard (0.05 mg/L for selenium) and if groundwater is contributing to surface water bodies such that the surface water quality standard (0.005 mg/L for selenium) is being exceeded. The decision therefore involves determining if the groundwater quality and hydraulics lead to either standard being exceeded and if so, the spatial extent of the exceedance.*

##### Step 3 – Identify the Information Inputs

- Some groundwater monitoring wells on or near Monsanto's inactive mines appear to have selenium concentrations in excess of the relevant compliance level of 0.05 mg/L. (Note: Validation of the data is not yet complete at this time, so this statement must be regarded as preliminary.) The data collected from the direct-push investigation have been used in conjunction with the data collected from the existing monitoring wells to estimate or predict the spatial extent of the contaminated groundwater, if found, and the probable concentrations within the bounds of the spatial extent. *Results from the 2008 direct-push investigation help define the scope of the 2009 effort to define the extent of contamination in the shallow alluvial aquifer to a level sufficient for decision making. Surface expressions of groundwater may be available for groundwater monitoring points for characterization of the shallow aquifer selenium plumes.*
- *Apparent direction of groundwater flow.*

- Additional secondary information inputs may include hydrogeologic factors, flow rates, distance to nearby surface water discharge areas, and concentrations relative to compliance thresholds and background.

#### Step 4 – Define the Boundaries of the Study

- The temporal boundary for the 2009 field investigation is early May to early July, due to the nature of contaminant transport correlating with spring runoff and potential hydraulic connections between the shallow alluvial system and surface water.
- The boundaries of significant groundwater contamination are defined by compliance thresholds.
- Specific spatial gaps that need to be filled by the 2009 investigation include the east and west sides of Ballard Mine, the mid-northern and southern portions of Henry Mine, and the south-southwestern portion of Enoch Valley Mine.
- Additional direct-push holes beyond those indicated in the plan may be located in the field if the hydrogeologist overseeing the program identifies additional areas that merit investigation.
- Hydrogeologic factors may be used to define the boundaries of the study.

#### Step 5 – Develop the Analytic Approach

- The relevant compliance threshold linked to protection of human health is 0.05 mg Se/L in groundwater.
- The relevant compliance threshold linked to protection of ecological health is 0.005 mg Se/L in surface water (where groundwater contributions are responsible for elevating surface water concentrations).
- *If shallow groundwater selenium concentration exceeds decision error lower bound (DELB), then further direct-push sampling may be required, otherwise the selenium plume is considered bound by the direct-push location. The DELB is the concentration above which the selenium concentration cannot be confidently said to be below the relevant compliance threshold level given the uncertainty in the sample datum.*
- Professional judgment also needs to be utilized in the evaluation of the data to account for hydrogeologic and other factors including but not limited to:
  - variability due to sampling or analytical error;
  - proximity to surface water;
  - groundwater discharge to surface water;
  - concentration trends in nearby wells;
  - spatial coverage of the direct-push samples;
  - proximity of the direct-push samples to potential source areas;
  - proximity to property boundaries; and
  - natural background concentrations.

#### Step 6 – Specify Performance or Acceptance Criteria

- Given that the project goals include generally defining the nature and extent of contamination, including the determination of the extent of groundwater impacts based on the groundwater selenium standard of 0.05 mg/L, and considering the uncertainty associated with instantaneous direct-push reconnaissance groundwater sampling methods, it will be useful to establish a protective lower bound above which the groundwater may be considered potentially impacted in relation to the groundwater standard. In consultation with the Agencies and Tribes, a decision error lower bound (DELB) of one-third the selenium groundwater standard, 0.017 mg/L, was chosen. This DELB value appears to provide a conservative threshold for deciding on whether to continue stepping out to define nature and extent of contamination, and in locations where concentrations are found to be less the DELB, there is a reasonable confidence that the standard is not being exceeded at that location at that time. Such decisions may be based on the DELB, as well as professional judgment, given the hydrogeologic conditions and observed variability in other groundwater samples collected over time at other groundwater monitoring locations at the P4/Monsanto mines.
- Utilizing 0.017 mg/L as the DELB for the reconnaissance investigation also allows for some assessment of areas where compliance with the surface water standard may need to be further evaluated. For areas where the selenium concentration is found to be below the DELB, there is a reasonable expectation that the groundwater standard is not being exceeded at that location. However, hydrogeologic factors also need to be considered when evaluating concentrations above and below the DELB, including for example, groundwater discharges to surface water in the area.

*If groundwater is discharging to surface water in an area being evaluated, then the surface water standard also needs to be considered when evaluating groundwater concentrations.*

- *A number of longer-term monitoring wells will be installed as part of the direct-push program. These wells will be monitored for some period of time generating a data set of groundwater quality results that can be used to assess temporal trends and contaminant variability in the groundwater system. Statistical and graphical analyses will be utilized to assess the variability in the data and whether or not a groundwater standard may or may not be exceeded in the future, or if concentrations are decreasing thereby reducing the risk. In some cases statistical analyses may be appropriate to assess if the location is in compliance with the groundwater standard for specific analytes. Tolerable limits on analytical and sampling error are included in the QAPP.*
- *Samples will be analyzed using an EPA-approved method with a detection limit lower than required for defining the extent of selenium contamination as described above.*

#### Step 7 – Develop the Plan for Obtaining Data

- *This direct-push field sampling plan was developed to continue ongoing characterization of the nature and extent of the selenium plumes in the shallow aquifers. This effort may complete the investigation of the shallow alluvial system, but such conclusions can only be made following the assessment of the data.*
  - *Direct-push monitoring wells will be installed at key locations to monitor temporal trends and confirm analyte concentrations within and outside of the plume of elevated selenium concentrations, and to monitor concentrations of other contaminants of potential concern. Once such a monitoring network has been in place for a while sufficient data will be available to better define the extent of contamination.*
-

#### 4.0 SAMPLE LOCATIONS AND FREQUENCY

Several boreholes will be advanced within the areas of the Ballard, Henry, and Enoch Valley mines described above, if conditions are appropriate. These locations are shown in Drawings 1 through 8 presented at the end of this FSP. As noted above, the locations depicted in the drawings indicate general locations and indicate the approximate extent and strategy for sampling. Locations may be adjusted and additional boreholes may be advanced or currently proposed ones may be deleted based on observations made while in the field and during drilling, such as areas where alluvium exists or does not exist.

Other factors that may affect borehole placement include physical and property owner access, depth to water and sediment permeability. For example, if water is located in high permeability alluvial sand and gravel, sampling may be extended further down gradient. Generally, boreholes will be located along alluvial depressions on the assumption that groundwater will be more likely reachable with the direct-push system in these areas, and that they represent likely locations for alluvial flow pathways.

The timing of the sampling is important. The program should not be conducted during the snowmelt event, but shortly thereafter. During snowmelt, ground conditions may be too wet for accessing some locations. However, following the snowmelt event there is also likely to be a time lag until the peak in the groundwater levels is observed. The direct-push program will be targeted for mid-May to mid-June.

Table 1 presents the proposed borehole locations for the 2009 continued investigation. These locations have been identified using AutoCAD software. As such, these locations are approximate and may be adjusted in the field based on professional judgment of site conditions.

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**TABLE 1**  
**2009 DIRECT-PUSH BOREHOLE LOCATIONS**

	<b>Northing</b>	<b>Easting</b>	<b>Borehole ID</b>
1	423352.660	689037.889	BH126
2	423654.899	689558.808	BH127
3	422722.409	689953.350	BH128
4	423598.036	690269.987	BH129
5	424064.268	690601.795	BH130
6	428010.373	685777.862	BH131
7	427608.991	686329.873	BH132
8	427085.204	687243.194	BH133
9	418064.231	679320.202	BH134
10	418010.807	678797.456	BH135
11	418512.118	678619.755	BH136
12	420840.389	678999.390	BH137
13	420616.686	678568.141	BH138
14	420745.926	678054.441	BH139
15	421908.402	677788.860	BH140
16	422381.954	678355.403	BH141
17	422229.813	679010.185	BH142
18	422956.709	678722.926	BH143
19	423700.658	679120.204	BH144
20	423992.710	679563.810	BH145
21	424213.391	678897.453	BH146
22	424915.627	678802.101	BH147
23	425863.694	678785.209	BH148
24	427301.285	679340.849	BH149
25	450124.123	682723.076	BH150
26	450226.730	681843.226	BH151
27	451018.268	681425.297	BH152
28	449631.385	682151.489	BH153
29	438179.121	705003.529	BH154
30	438718.462	704300.296	BH155
31	439033.110	704539.912	BH156
32	437600.017	693460.900	BH157*
33	436871.941	693836.486	BH158*

Notes:

\* = Tentative locations

Projection: State Plane Coordinate System;Zone: Idaho East; Datum: North American Datum, 1927 (NAD27);Vertical Datum: North American Vertical Datum, 1929 (NAVD29); Units: US Feet;

## 5.0 SAMPLE DESIGNATION

All samples will be labeled in a clear, precise way for proper identification in the field and for tracking in the laboratory. The samples will have identifiable and unique numbers. At a minimum, the sample labels will contain the following information:

- Facility name
- Sample number
- Sample depth
- Date of collection
- Time of collection
- Method of sample preservation

A coding system will be used to uniquely identify each sample collected. The system will allow for quick data retrieval and sample tracking.

### 5.1 Labeling

The sample designation (Sample ID) will be recorded on the sample labels, logbook, sample tracking sheet(s), and chain-of-custody forms, and will comprise three parts or fields.

1. Part 1 will designate the mine and sampling area:
  - EnochA
  - Henry D
  - BallardE
  - BallardF
  - BallardG
2. Part 2 will be a field that begins with alphabetic characters that identify the type of sample:
  - GW = primary and duplicate groundwater samples
  - EQ = equipment rinsate samples
3. Three digits will follow the alphabetic character(s) and will correspond to the identification number and locations included on Table 1. Any additional samples collected will be numbered sequentially following the last sample number in Table 1 (i.e., 158). Equipment rinsate samples will be numbered sequentially. The sample number for each primary sample will correspond to the borehole location ID number. Primary and equipment rinsate sample numbers in 2009 will start with 400 and go up.

As an example, sample designation BallardE-GW118 was the groundwater sample collected from the location BH118 (Table 1) in the Ballard Mine, Area G. The first blind duplicate sample collected would be labeled BallardE-GW400.

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Blind duplicate and rinsate sample numbers will not correspond to borehole numbers, and will start at 400 and go up from there, regardless of the area or location.

If the groundwater sampling program is extended outside of the aforementioned designated areas, the samples collected in the area will receive a sample ID based on the designated area closest to the sample location. For example, if a sample is collected in the area north of Enoch Valley Area A, labeling for those samples will follow the convention for samples collected from Enoch Valley Area A. All designated area boundaries adjusted during the field work, due to additional sample collection, will be shown on the maps included in the final report.

## **6.0 SAMPLING EQUIPMENT AND PROCEDURES**

Direct-push borehole locations presented in this FSP are approximate. They are intended to illustrate the sampling strategy and be a guide for selecting locations in the field. Actual locations will be field located based on access to the location, surface conditions and geology, and probable flow paths based on observation of overall conditions. The types of alluvial sediments encountered will also be used to guide the program. If high permeability sediment is encountered, the sampling program may be extended down gradient. Conversely, the sampling program may be pulled closer to the potential sources if only low permeability material predominates. This concept is based on contaminant transport velocities. For very permeable sediments, velocities could be 100s of feet per year, opposed to lower permeability sediments where velocities may be a few feet per year. In all likelihood, the distribution of the boreholes will be per the drawing presented herein.

### **6.1 Site Access**

Prior to mobilizing into the field, P4 will arrange for authorization to enter and conduct the scope of work on all public and private land. It is assumed that all locations will be physically accessible by the truck-mounted direct-push rig and supporting vehicles; no road improvements will be required. It will be the responsibility of P4 to coordinate access to an area with obstructions (e.g., fences or berms), if alternate routes are not an option.

### **6.2 Drilling and Soil Sampling**

The boreholes will be advanced to first encountered groundwater within the Quaternary and older alluvium and colluvium<sup>1</sup> using a truck-mounted direct-push rig (e.g., Geoprobe®). The direct-push rig utilizes the weight of the rig to push a drive point or coring device into the soil, and can reach depths of up to 100 feet, depending on the size of the rig and the nature of the subsurface soils. The majority of the boreholes for this project will extend to between 10 and 30 feet below ground surface (bgs); some may be shallower and a few may extend slightly deeper if conditions are favorable.

Two methods of identifying and sampling groundwater will be utilized: a coring system or a drive point groundwater sampler. The first method utilizes a soil coring system, which allows the collection of soil cores in three to five-foot intervals. The preferred method will be a dual-tube sampling method (ASTM, 2005a) where samples can be extracted in an inner core tube while an outer tube is left in place. This will allow for the highest level of scrutiny for the presence or absence of groundwater. This method is somewhat slower than the drive-point method, but has two advantages. One advantage is the ability to closely examine the soil core for the presence or absence of groundwater. The second advantage is that since the soil core system cuts the soil and removes material, it is more effective at exposing groundwater and allowing recharge into the borehole in low-permeability formations. The drive point system displaces and pushes soil out into the formation, which can reduce the rate or volume of groundwater recharge into the borehole. The standard operating procedures presented in MWH (2005 & 2007a) will also be utilized as applicable. Other guidance used to shape the direct-push investigation include:

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<sup>1</sup> For ease of discussion colluvium is grouped with alluvium in this document.

- Groundwater Sampling and Monitoring with Direct-push Technologies (USEPA, 2005).
- Standard Guide for Direct-push Soil Sampling for Environmental Site Characterizations (ASTM, 2005a).
- Standard Guide for Direct-push Ground Water Sampling for Environmental Site Characterization (ASTM, 2005b).
- Standard Practice for Direct-push Installation of Prepacked Screen Monitoring Wells in Unconsolidated Aquifers (ASTM, 2005c).

This plan provides the guidance for the field program. However, this program is at the reconnaissance level and needs to be adaptable to the subsurface conditions encountered. Therefore, the direct-push contractor and hydrogeologist overseeing the program may need to use some latitude to adapt to the conditions encountered. Any modifications made to the procedures or changes in equipment presented herein will be documented. At all times, the best practicable sampling procedures for obtaining quality representative samples will be used given the hydrogeologic conditions encountered.

The disadvantages of the coring system are that it is somewhat slower, and does not filter the water sample by way of a screen. Groundwater samples will be collected by extracting the inner sampling tube and allowing the outer tube to fill with water, and will be collected with a bailer or pump as described in USEPA (2005). In some locations, the outer tube may be partially extracted to expose specific water bearing intervals identified in the core. If needed, a temporary well screen may be used in the borehole. This screen and riser pipe would be placed through the outer tube, and then the tube partially extracted to expose the screen to the formations of interest.

Core samples will be logged and borehole logs generated for each direct-push location that is cored. The decision to obtain a core sample will remain a field-based decision. Select portions of the saturated zone of each core sample will be collected and archived at a secure location provided by P4. If needed, these archived samples can be analyzed at a later date to assess material properties, such as grain size and hydraulic characteristics of the shallow alluvial aquifer material. Archived samples will not be tested for selenium or other potential contaminants of concern.

The second method will utilize a drive point with a stainless steel sealed screen system (ASTM, 2005b) that is covered during drilling and then can be exposed at the target interval for groundwater sampling. This method does not recover any soil, and therefore requires one to initially predict the depth to groundwater, and then once the target depth is reached, the screen can be exposed. If no water is present, the drive point can be advanced further, or pulled up to a shallower depth, to find groundwater. This method may be used in boreholes where the depth to groundwater can be reasonably predicted based on other information (e.g., evidence of shallow groundwater like spring discharges). The drive-point method will be utilized whenever possible to reduce the drilling time.

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After drilling and sampling are complete in each borehole, the hole will be filled with granular bentonite to above the water table. The ground surface around each borehole will be restored to match the existing ground cover.

### **6.3      Prepacked Well Screen Installation and Development**

Some direct-push borehole locations may be constructed as small diameter monitoring wells (ASTM, 2005c). The decision to install these wells will be based on location, and be made by the field crew. These wells will consist of 1.5 inch by 2.5 inch OD prepacked well screen. The assembly consists of PVC pipe surrounded by environmental grade sand contained within a stainless steel wire mesh cylinder. The inner component of the prepacked screen is a flush-threaded, 0.5 inch Schedule 80 PVC pipe with 0.01 inch slots. Stainless steel wire mesh with a pore size of 0.011 inches makes up the outer component of the prepack. The space between the inner slotted pipe and outer wire mesh is filled with 20/40 mesh silica sand. Either 3 or 5 foot sections will be used. Prepacked wells will be installed and developed in accordance with ASTM documents located in Appendix B.

### **6.4      Groundwater sampling**

Groundwater samples will be collected in one of two ways: using the stainless steel screen of the drive-point system, through the macro-core borehole, or from prepacked screens installed in select direct-push boreholes. The choice to choose one method will be a field-based decision. The stainless steel screen point (e.g., a Geoprobe® Screen Point 15 or 16) groundwater sampling system is a protected screen sampler with a retractable sheath and an expendable drive point. While the sampler is advanced to depth, O-ring seals at each rod joint, the drive head, and the expendable drive point provide a watertight system preventing formation water from entering the screen before deployment and assures sample integrity. Once the desired sampling interval is reached, extension rods are sent down hole until the leading rod contacts the bottom of the sampler screen. The tool string is then retracted up to 44 inches while the screen is held in place with the extension rods. As the tool string is retracted, the expendable point is released from the sampler sheath. The tool string and sheath may be retracted the full length of the screen or as little as a few inches if a small sampling interval is desired. Once the screen is exposed and groundwater has recharged into the sampler, the groundwater sample will be collected from the screen point using dedicated polyethylene tubing lowered into the hole and a peristaltic pump at the surface.

In boreholes where a dual tube sampler is used, the inner soil sampling tube will be extracted and the outer tube allowed to fill with water. The water will then either be extracted with a peristaltic pump or mini-bailer. If a specific water bearing zone is identified in the core, then the outer tube can be retracted to a point above the target zone. If the borehole collapses or excessive turbidity is an issue then a small well screen and riser pipe may be inserted through the outer tubing.

If the borehole yields sufficient water without affecting the integrity of the borehole, some water will be produced in an attempt to develop the location and remove sediment, and low-flow purging and sampling methodology will be utilized, as practicable. However, groundwater yields are expected to be generally low and the micro-purging or passive sampling procedure will be applied at most locations (USEPA, 2005). This method is also

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most applicable to the sampling tools that will be utilized. With this method minimal water is produced with the goal of collecting the water within the screened interval of the sampler. With the direct-push program sampling will occur almost immediately after exposure of the groundwater bearing zones, and as such, a stagnant water column in the borehole will not be a concern.

At direct-push locations where prepacked well screens have been installed, groundwater will be extracted with either a peristaltic pump or mini-bailer.

Sampling will be conducted so that samples will be collected in a continuous sequence with the advancement of the borehole (i.e., samples will not be collected after a borehole has stood open overnight). A possible exception could occur if the only water bearing zones located yield water so slowly that an extended period of time is required for sufficient water volume to collect in the borehole for sampling. In such a case, a temporary well screen and riser may be left in the borehole, and sampling may be attempted on the following day.

All the groundwater samples will be field filtered using a disposable 0.45 micron ( $\mu\text{m}$ ) filter prior to filling the sample containers. Field filtering will be used to reduce turbidity produced when sampling without a filter pack or, in most cases, limited development. This will provide comparable samples without the bias that may be introduced from varying amount of aquifer matrix in the sample. If the samples are collected with a pump, an in-line disposable filter will be placed on the pump discharge line and the groundwater sample will be collected directly into the sample container from the filter discharge. If the samples are collected with a bailer, the sample will first be transferred to a clean container, and then filtered using a peristaltic pump equipped with Teflon tubing and an in-line 0.45  $\mu\text{m}$  disposable filter. The inlet of the pump tubing will be placed in the groundwater sample and the sample will be pumped through the filter and collected into the sample container from the filter discharge. The filters will be discarded after each use.

## **6.5      Surveying**

Each borehole location and other pertinent features observed in the field will be surveyed using a hand-held global positioning system unit (GPS). A GPS with a WAAS-capable receiver will be used, which typically will provide an accuracy of less than 10 feet.

All measurements will be referenced to the State Plane Coordinate System, North American Datum 1927.

## **6.6      Slug Testing**

Slug testing will be completed using a Geoprobe® pneumatic slug test kit. Slug testing methods are outlined in the standard operating procedures located in Appendix A. Slug testing will be completed at select sites in each flow path based on the conditions encountered at each direct-push location. Boring logs completed during the installation of the prepacked well screens will be reviewed to aid in the selection process. At a minimum one direct-push location in each flow path will be slug tested to assess the hydraulic conductivities within the shallow alluvium and upper Dinwoody Formation.

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## 6.7 Field Quality Control Samples

Blind sample duplicates and equipment rinsate samples will be collected at a rate of one per 20 samples, if practicable. The blind duplicate samples will be collected from the same borehole using the same methods as the primary sample. The samples will be given a different sample ID, which along with date, time and team members will be recorded in the field log book. Additionally, a separate list of blind duplicate samples and their associated primary samples will be maintained, to ensure that the correct blind and primary samples pairs are recorded. Collection of duplicate samples may be limited to boreholes with sufficient yield to provide duplicate samples within a reasonable time.

To the extent possible and practical, dedicated sampling equipment will be used (e.g., new plastic peristaltic pump tubing). However, equipment rinsate blanks will be prepared at the Site by passing laboratory-provided reagent water of known quality through decontaminated non-dedicated sampling equipment (e.g., the stainless steel screen). In addition to collection of a rinsate sample for every 20 primary samples, an equipment rinsate sample will be collected just before final use of any non-dedicated sampling equipment. The samples will be submitted to the laboratory and analyzed for the same analytes that are specified for associated field samples.

The field log will identify the team members, date, and sampling area and location. This identification procedure will associate the blind duplicate and equipment rinsate samples with a specific team and sample location.

## 6.8 Decontamination Procedures

All non-disposable or non-dedicated sampling equipment will be cleaned and decontaminated prior to use at each location. The sampling equipment will be decontaminated using a pressure washer, if available. Otherwise, the equipment will be decontaminated as follows:

- Wash the equipment in low- or non-phosphate detergent (e.g., Alconox® or Liqui-Nox® solutions made as directed by the manufacturer);
- Rinse with potable water; and
- Rinse twice with laboratory-grade deionized or distilled water.

The rinse water will be dispersed on the mine site away from surface water drainages where it will either evaporate or infiltrate back into the ground.

## 6.9 Sample Containers

Groundwater samples will be sealed in 250 milliliter polyethylene bottles supplied by the laboratory. Chemical preservative (0.5% nitric acid) will be added to the sample containers by the laboratory prior to sampling. After collection, samples will be properly stored to prevent degradation of the integrity of the sample prior to its analysis. Samples will be analyzed within the prescribed holding time. Sample preservation and holding times are to be maintained from the time of sampling until the time of analysis. Each cooler will contain a chain-of-custody that documents the samples in that particular cooler.

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Soils samples recovered from direct-push boreholes will be placed in labeled quart-size zip-lock bags. Labels will include the borehole number, date sampled, and sample interval (referenced from the ground surface). The soil samples will then be placed in plastic containers and transferred to a storage location at a Monsanto facility for archiving.

#### **6.10 Disposal of Investigation Derived Waste**

Generation of investigation derived waste (IDW), such as equipment decontamination wastewater, rinsate, soil cuttings, sample containers, and personal protective equipment (PPE) will be minimal. The minimal soil cuttings, rinse water and produced water will be dispersed at the sample site. Water will be dispersed away from surface water courses.

#### **6.11 Well Abandonment**

Idaho Department of Water Resources (IDWR) regulation (IDAPA 37.03.09.12a) for well abandonment will be followed if prepacked direct-push boreholes or piezometers require abandoning during this field effort. In general the procedure for abandoning the aforementioned is as follows:

- If practical, the casing will be pulled out of the borehole, otherwise it will be left in place.
- The borehole or casing will be sealed from the bottom up with bentonite grout, cement grout or cement by using a tremie pipe.

#### **6.12 Field Notes**

The on-site geologist will use a weather-resistant, bound, survey-type field logbook with numbered, non-removable pages to record in black or blue indelible ink all field activities. Daily information entered in the logbook will include:

- Dates and times
  - Name and location of the work activities
  - Precise location identification numbers
  - Northing and easting coordinates
  - Weather conditions
  - Personnel, subcontractors and visitors on site
  - Sample locations and methods (including sampling equipment)
  - Time of sample collection, and sample depths
  - Samples submitted to the laboratory for analyses
  - Sample type (e.g., groundwater, rinsate water, or blind duplicate)
  - Name of carrier transporting the sample (e.g., name of laboratory and shipping carrier)
  - Photograph numbers and descriptions (if applicable)
  - Description of decontamination activities
  - Schematic drawings of sample locations (if not done on field forms)
  - Any deviations from the work plan
  - Health & Safety meetings, including topics discussed and attendees
  - Accidents, including near misses
-

- Other relevant observations as the field work progresses
- Problems and corrective actions
- Field equipment calibration methods
- Investigation derived waste

At the end of each field day, the project field book will be dated and signed by the field person who took notes during the day. If the entire page is not used a line will be drawn through the unused portion of the page. If pages are accidentally skipped, a line will be drawn through the entire page. All corrections will be made by drawing a line through the erroneous information and initialing the change.

### **6.13 Chain-of-Custody**

Each sample will be properly documented to facilitate timely, accurate, and complete analysis of data. The documentation system is used to identify, track, and monitor each sample from the point of collection through final data reporting. Chain-of-custody protocol will be implemented and followed for all samples. A sample is considered to be in a person's custody if it is: 1) in a person's physical possession, 2) in view of the person after taking possession, or 3) secured by that person so that no one can tamper with it.

Chain-of-custody forms will be used to ensure that the integrity of samples is maintained. Each form will include the following information:

- Sample number
- Date of collection
- Time of collection
- Sample depth
- Analytical parameter
- Method of sample preservation
- Number of sample containers
- Shipping arrangements and air bill number, as applicable
- Recipient laboratories
- Signatures of parties relinquishing and receiving the sample at each transfer point

Whenever a change of custody takes place, both parties will sign and date the chain-of-custody form, with the relinquishing person retaining a copy of the form. An exception to this is the transportation company. The party that accepts custody will inspect the custody form and all accompanying documentation to ensure that the information is complete and accurate. Any discrepancies will be discussed with the MWH project manager and noted on the chain-of-custody form.

### **6.14 Packaging and Shipment**

After collection, samples will be properly stored to prevent degradation of the integrity of the sample prior to its analysis. As applicable, this includes the use of the appropriate chemical preservative (0.5% nitric acid), storing the sample in an appropriate container, and analyzing the sample within prescribed holding times. Sample preservation and holding times are to be maintained from the time of sampling until the time of analysis.

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Samples will be sealed in the appropriate sampling container. Sample containers will be placed in clean protective foam or bubble pack sleeves, as appropriate. The caps of all sample bottles shall be checked for tightness to prevent sample leakage during transport. Care will be taken to prevent over-tightening and breakage of bottle caps. Custody seals will be placed on each cooler for shipment such that it must be broken to open the cooler.

The samples will be packed securely in an ice chest or other appropriate container, and samples will be preserved in accordance with the specification. Sufficient packing material will be placed in each ice chest to minimize the potential for sample bottles to shift and become damaged or broken during shipment. Packing material may include bubble pack or foam material. The drain plug on the shipping container will be closed and sealed on the inside and outside with duct tape.

Sampling personnel will inventory the sample bottles from the Site prior to shipment to ensure that all samples listed on the chain-of-custody form are present. All bottles collected from a specific sampling interval will be packed and shipped together in the same shipping container. The originals of the analysis request and chain-of-custody forms will be sealed in a waterproof plastic bag and placed inside the shipping container prior to sealing of the container. The cooler will be taped shut using strapping tape over the hinges and custody seals placed across the top and sides of the cooler lid. One or more custody seals will be signed, dated, and placed on the front and back of the sample cooler prior to transport. Clear tape will be placed over the custody seals to prevent inadvertent damage during shipping. The tape should not allow the seals to be lifted off with the tape and then reaffixed without breaking the seal.

All samples designated for off-site laboratory analysis will be packaged and shipped in accordance with applicable U.S. Department of Transportation regulations. Samples will be shipped no faster than 2-day air or ground transportation using FedEx or UPS. The lead team member will maintain shipment tracking numbers and verify that the shipments have reached their destination at the appropriate time.

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## **7.0 SAMPLE HANDLING AND ANALYSIS**

### **7.1 Chemical Analysis**

A groundwater sample will be collected from each borehole advanced at the locations described in Section 4.0. Each sample will be tested in the field for pH and electrical conductivity. The samples will then be submitted to a chemical laboratory for analysis of selenium. Direct-push boreholes typically yield small quantities of turbid groundwater at low inflow rates. If the boreholes yield sufficient water they will be pumped or bailed in an attempt to develop the sampling point and produce less turbid water. However, because the direct-push groundwater samples will likely have variable levels of relatively high turbidity, all samples will be field filtered, acidified, and submitted to the laboratory for dissolved selenium analysis. If this were not done, individual samples would not be comparable because the variable concentrations of suspended sediment would have an effect on the total selenium concentration. Total analysis would therefore add an additional variable that would limit the ability to compare sample points. Filtering will remove the variable associated with mineral and sorbed selenium in the water sample. The samples are used to develop reconnaissance level data and will not be used for regulatory compliance assessment; therefore, the use of filtered samples is acceptable.

### **7.2 Analytical Methods**

The samples will be laboratory analyzed for dissolved selenium as the key indicator parameter, using analytical method EPA 6020A. The reporting limit is 0.001 mg/L; the method detection limit is 0.0005 mg/L.

Samples will be sent to Microbac laboratory at the following address:

Microbac Laboratory  
Ohio Valley Division  
158 Starlite Drive  
Marietta, OH 45750

(800) 373-4071 (phone)  
(740) 373-4835 (fax)

All filtered groundwater samples will be field preserved with a 0.5% solution of nitric acid to lower the sample pH to less than 2. The samples will not be preserved prior to filtering. The samples will be placed on ice for shipping to the laboratory. The holding time is 180 days.

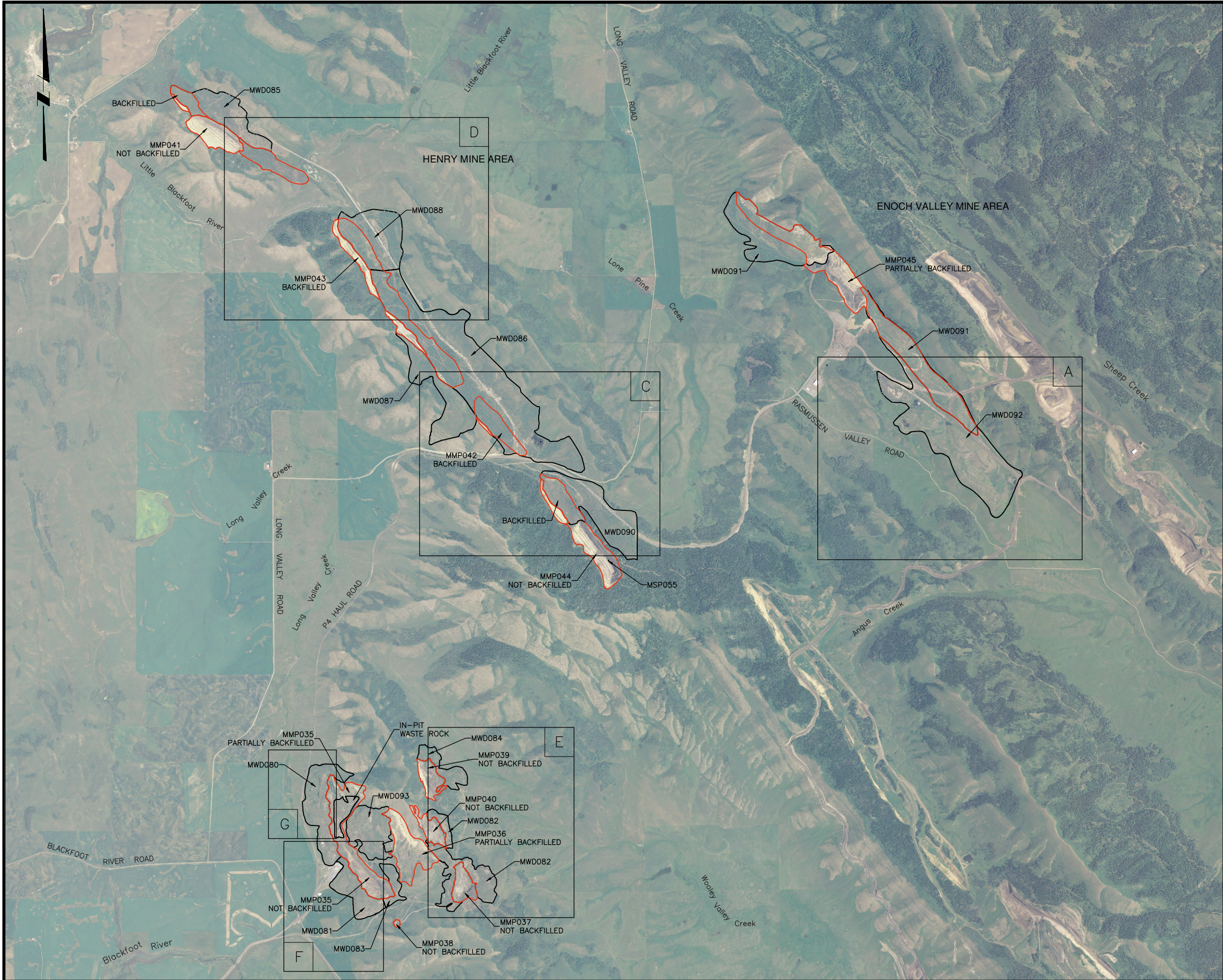
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## 8.0 REFERENCES

- ASTM International (ASTM), 2005a. *Standard Guide for Direct-push Soil Sampling for Environmental Site Characterizations*. Designation: D 6282-98 (Re approved 2005), 18 p.
- ASTM International (ASTM), 2005b. *Standard Guide for Direct-push Ground Water Sampling for Environmental Site Characterization*. Designation: D 6001-05, 16 p.
- ASTM International (ASTM), 2005c. *Standard Practice for Direct-push Installation of Prepacked Screen Monitoring Wells in Unconsolidated Material*. Designation D 6725-05, 15 p.
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- MWH, 2008b. *Conditional Final - 2007 Hydrogeologic Data Collection Activities and Updated Conceptual Models - Interim Report for Hydrogeologic Investigation*. Revision 3, prepared for P4 Production L.L.C., December 2008. Conditionally approved by A/T on January 6, 2009.
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- MWH, 2004c. *P4 Production Southeast Idaho Mine-Specific Selenium Program 2004 Comprehensive Site Investigation Enoch Valley Mine Work Plan—Final*. March 2004.
- MWH, 2004b. *Comprehensive Site Investigation, Health and Safety Plan – Final*, April 2004.
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## **DRAWINGS**

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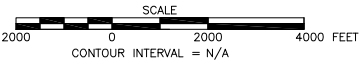
**LEGEND:**

- MINE PIT LOCATION (APPROXIMATE WHERE COVERED BY BACKFILL)
- WASTE ROCK PILE LOCATION
- WASTE ROCK PILE LOCATION OR PIT BACKFILL (APPROXIMATE)
- DIRECT-PUSH INVESTIGATION AREA

MMP = MINE PIT  
MWD = WASTE ROCK DUMP



**KEY MAP**  
N.T.S.



REV	DESCRIPTION	TECH	ENG	DATE
B	DRAFT	CHF	CLF	04/30/09
A	DRAFT	CHF	CLF	03/25/09

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2. ORIGINAL FILE LOCATED:  
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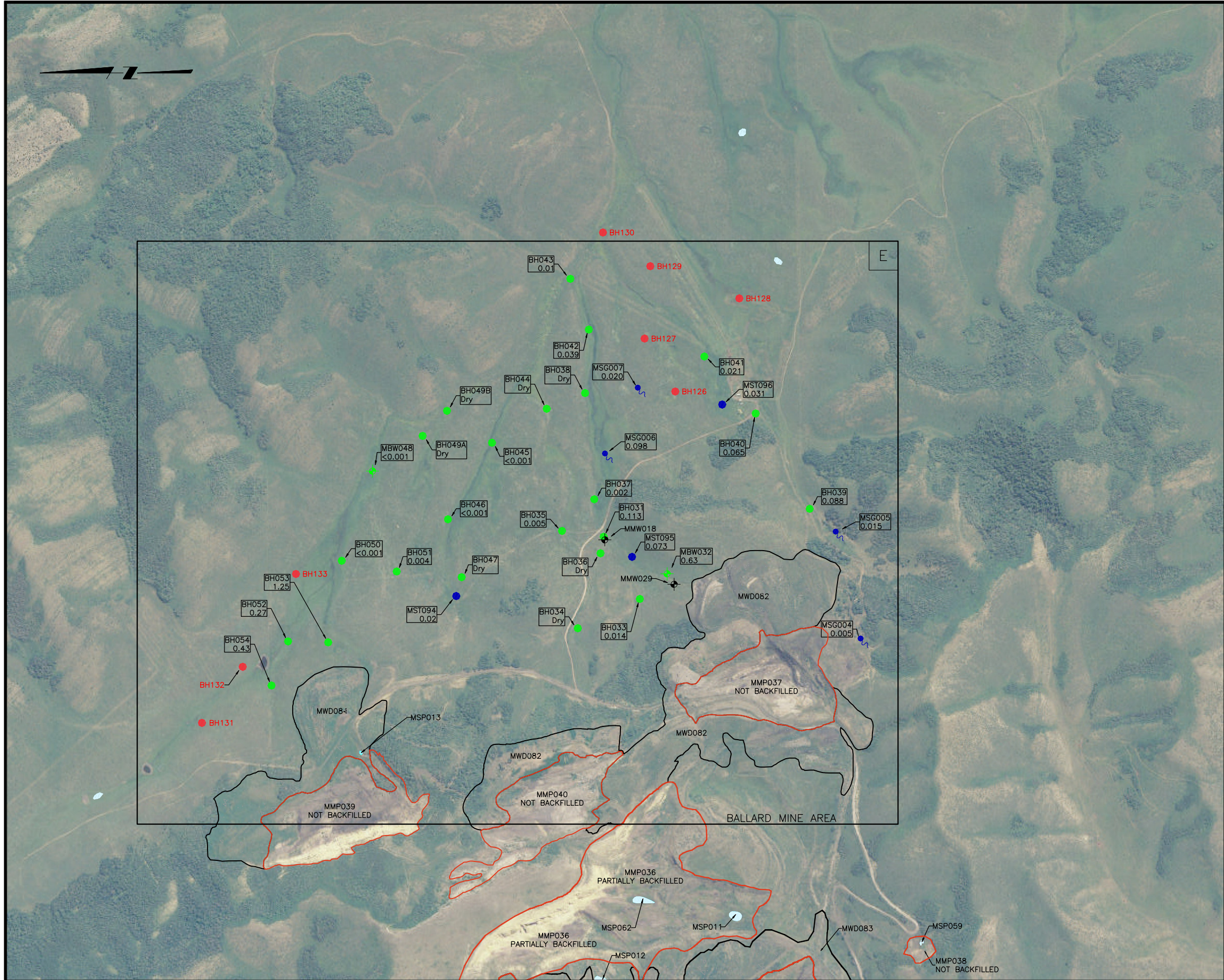
DESIGNED BY	C.FOULK	04/30/09
DRAWN BY	E.MARKS	04/30/09
CHECKED BY	C.FOULK	04/30/09
APPROVED BY	C.FOULK	04/30/09
PROJECT MANAGER	C.FOULK	04/30/09
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

**P4 PRODUCTION  
SITE INVESTIGATION**

PROJECT LOCATION	BALLARD, HENRY AND ENOCH VALLEY MINES	
PROJECT	2009 DIRECT-PUSH SAMPLING AND ANALYSIS PLAN	
TITLE	PROJECT LOCATION MAP	

SHEET	1 of 8	REVISION	B
FILE NAME	1005813D126		

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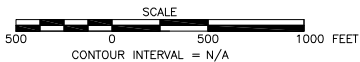
**LEGEND:**

- MINE PIT LOCATION
- WASTE ROCK PILE LOCATION
- WASTE ROCK PILE LOCATION OR PIT BACKFILL (APPROXIMATE)
- GROUNDWATER MONITORING WELL LOCATION
- DIRECT-PUSH MONITORING WELL INSTALLED IN 2008
- PROPOSED APPROXIMATE 2009 DIRECT-PUSH BOREHOLE LOCATION
- 2008 DIRECT-PUSH BOREHOLE LOCATION
- SPRING STATION
- STREAM STATION
- DIRECT-PUSH INVESTIGATION AREA
- DIRECT-PUSH BOREHOLE ID AND 2008 SELENIUM CONCENTRATION

**NOTES:**

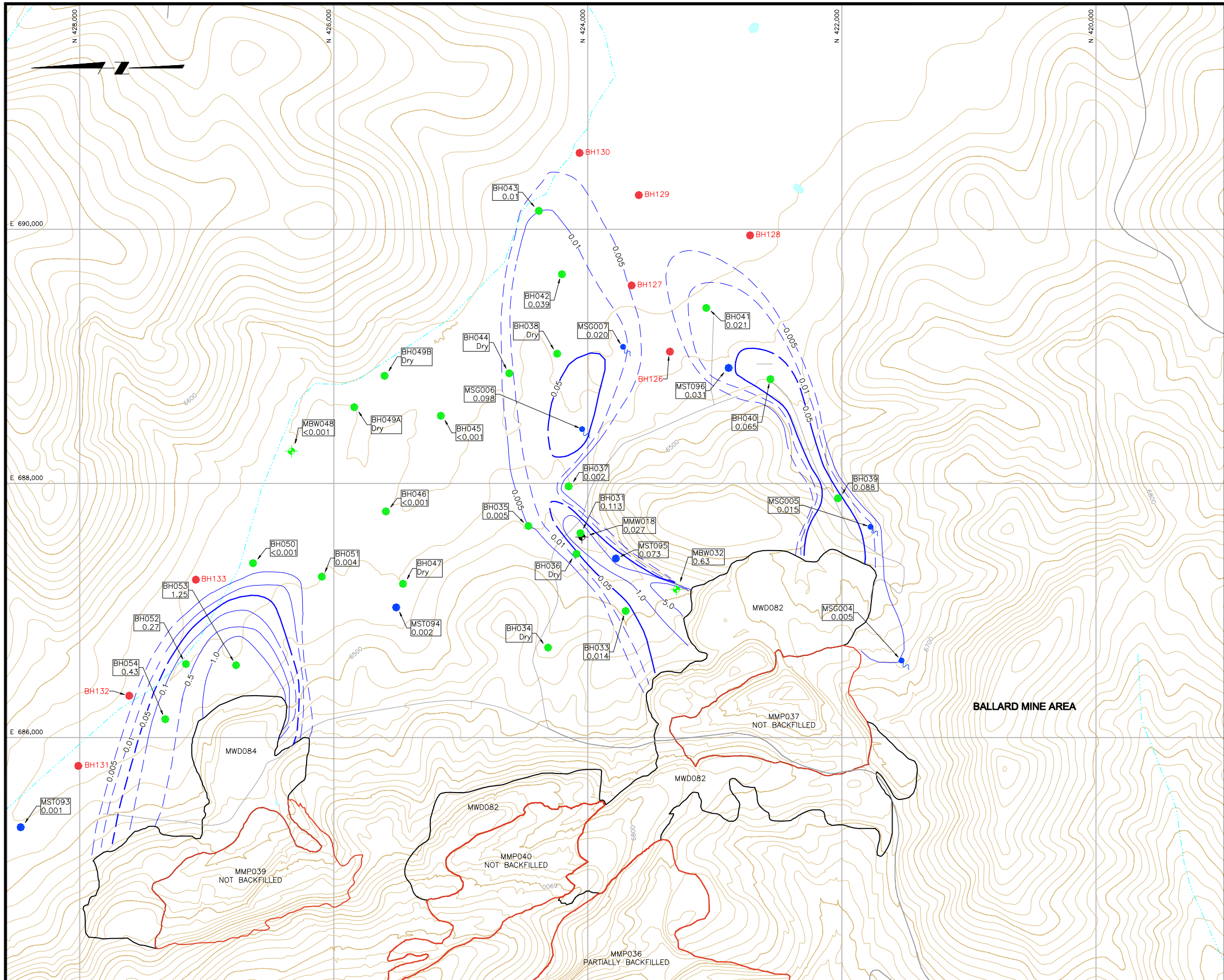
1. RESULTS ARE FOR GRAB GROUNDWATER SAMPLES AND ARE DISSOLVED CONCENTRATIONS OF SELENIUM IN mg/L.

- BH = DIRECT-PUSH BOREHOLE
- MAW = AGRICULTURAL WELL
- MBW = DIRECT-PUSH MONITORING WELL
- MDW = DOMESTIC WELL
- MMP = MINE PIT
- MMW = MONITORING WELL
- MPW = PRODUCTION WELL
- MWD = WASTE ROCK DUMP
- MSG = SPRING STATION
- MSP = POND
- MST = STREAM STATION



						<b>DISCLAIMER:</b> THIS DRAWING WAS DEVELOPED THROUGH THE APPLICATION OF PROFESSIONAL ENGINEERING SKILL AND PROPRIETARY METHODOLOGIES, PROCESSES, AND KNOW HOW OF MMH AS AUTHOR, ALL PURSUANT TO THE TERMS OF A CONTRACTUAL SCOPE OF WORK COVERING ITS PREPARATION. THIS DRAWING MAY NOT BE USED OR MODIFIED OTHER THAN IN STRICT ACCORDANCE WITH THE TERMS OF THE GOVERNING CONTRACT AND SCOPE OF WORK OR OTHERWISE ABSENT THE INVOLVEMENT AND CONSENT OF THE AUTHOR. ANY ALTERATION OR ADAPTATION OF THIS DRAWING SHALL BE CONSISTENT WITH THE AUTHOR'S CONTRACTUAL AND PROPRIETARY RIGHTS AND BE AT USER'S SOLE RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY OF MMH.	<b>DRAWING REFERENCE(S):</b> 1. ORTHOIMAGERY IS FROM NATIONAL AGRICULTURE IMAGERY PROGRAM (NAIP) FOR CARIBOU COUNTY, ID. 2. ORIGINAL FILE LOCATED: N:\Design-Drafting\Clients_I-P\ Monsanto-P4 Production\1005813 Working Base Map \006-Photos-Images\1005813 Ortho-Final.tif.		DESIGNED BY C.FOULK	04/30/09	<b>P4 PRODUCTION SITE INVESTIGATION</b>	PROJECT LOCATION <b>BALLARD, HENRY AND ENOCH VALLEY MINES</b>			
							DRAWN BY E.MARKS	04/30/09	PROJECT <b>2009 DIRECT-PUSH SAMPLING AND ANALYSIS PLAN</b>						
							CHECKED BY C.FOULK	04/30/09							
							APPROVED BY C.FOULK	04/30/09							
							PROJECT MANAGER C.FOULK	04/30/09							
B		DRAFT	CHF	CLF	04/30/09										
A		DRAFT	CHF	CLF	03/25/09										
ISSUE	REV	DESCRIPTION	TECH	ENG	DATE				CLIENT APPROVAL			TITLE <b>LOCATION OF DIRECT-PUSH BOREHOLES BALLARD MINE EAST</b>		SHEET <b>2 of 8</b>	REVISION <b>B</b>
												FILE NAME <b>1005813D127</b>			

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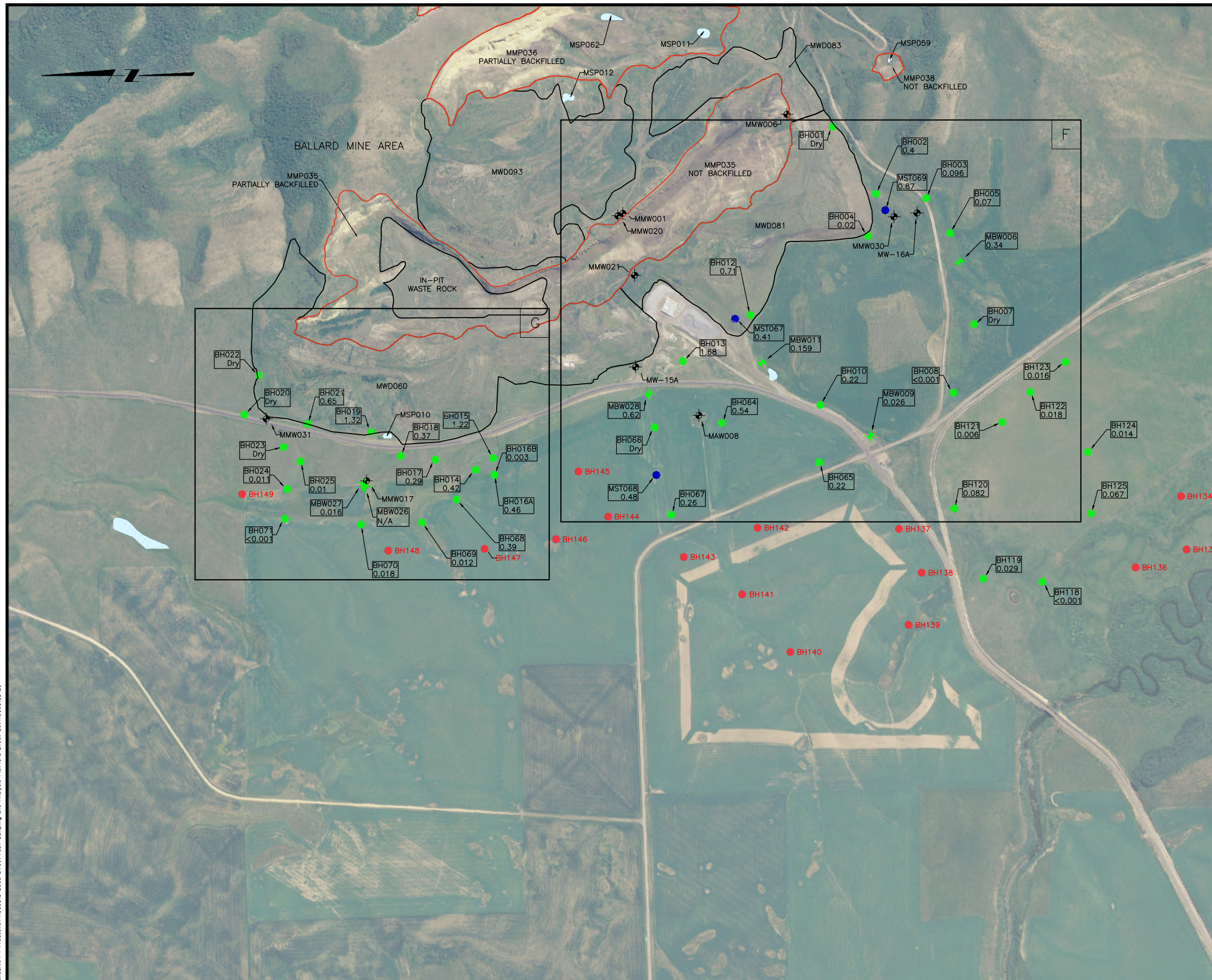
- 7000 POST-MINE CONTOUR & ELEVATION, FEET
- POND OR LAKE
- STREAM - PERENNIAL
- STREAM - INTERMITTENT
- MINE PIT LOCATION
- WASTE ROCK PILE LOCATION
- HIGHWAY
- ROAD
- RAILROAD
- P4 PRODUCTION HAUL ROAD (ACTIVE & INACTIVE)
- 0.05 TOTAL SELENIUM ISOCONCENTRATION CONTOUR (mg/L)
- 0.05 INFERRED TOTAL SELENIUM ISOCONCENTRATION CONTOUR (mg/L)
- MMW022 GROUNDWATER MONITORING WELL LOCATION
- MBW009 DIRECT-PUSH MONITORING WELL INSTALLED IN 2008
- PROPOSED APPROXIMATE 2009 DIRECT-PUSH BOREHOLE LOCATION
- 2008 DIRECT-PUSH BOREHOLE LOCATION
- SPRING STATION
- STREAM STATION
- BH039 0.088 DIRECT PUSH, ALLUVIAL WELL, SPRING OR HEADWATER STREAM LOCATION WITH 2008 TOTAL SELENIUM CONCENTRATION IN mg/L

NOTES:

- WHERE WELLS ARE NESTED IN THE ALLUVIAL FLOW SYSTEM (I.E. SHALLOW AND DEEPER) THE HIGHEST MEASURED CONCENTRATION IS USED FOR CONTOURING.
  - SPRING 2008 TOTAL SELENIUM CONCENTRATIONS ARE USED FOR MONITORING WELLS, SPRINGS AND HEADWATER STREAMS WHERE APPROPRIATE.
- ISOCONCENTRATION CONTOUR INTERVAL=LOG WITH SUPPLEMENTAL HALF CYCLE CONTOURS.

- BH = DIRECT-PUSH BOREHOLE
- MAW = AGRICULTURAL WELL
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- MMP = MINE PIT
- MMW = MONITORING WELL
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- MSG = SPRING STATION
- MST = STREAM STATION

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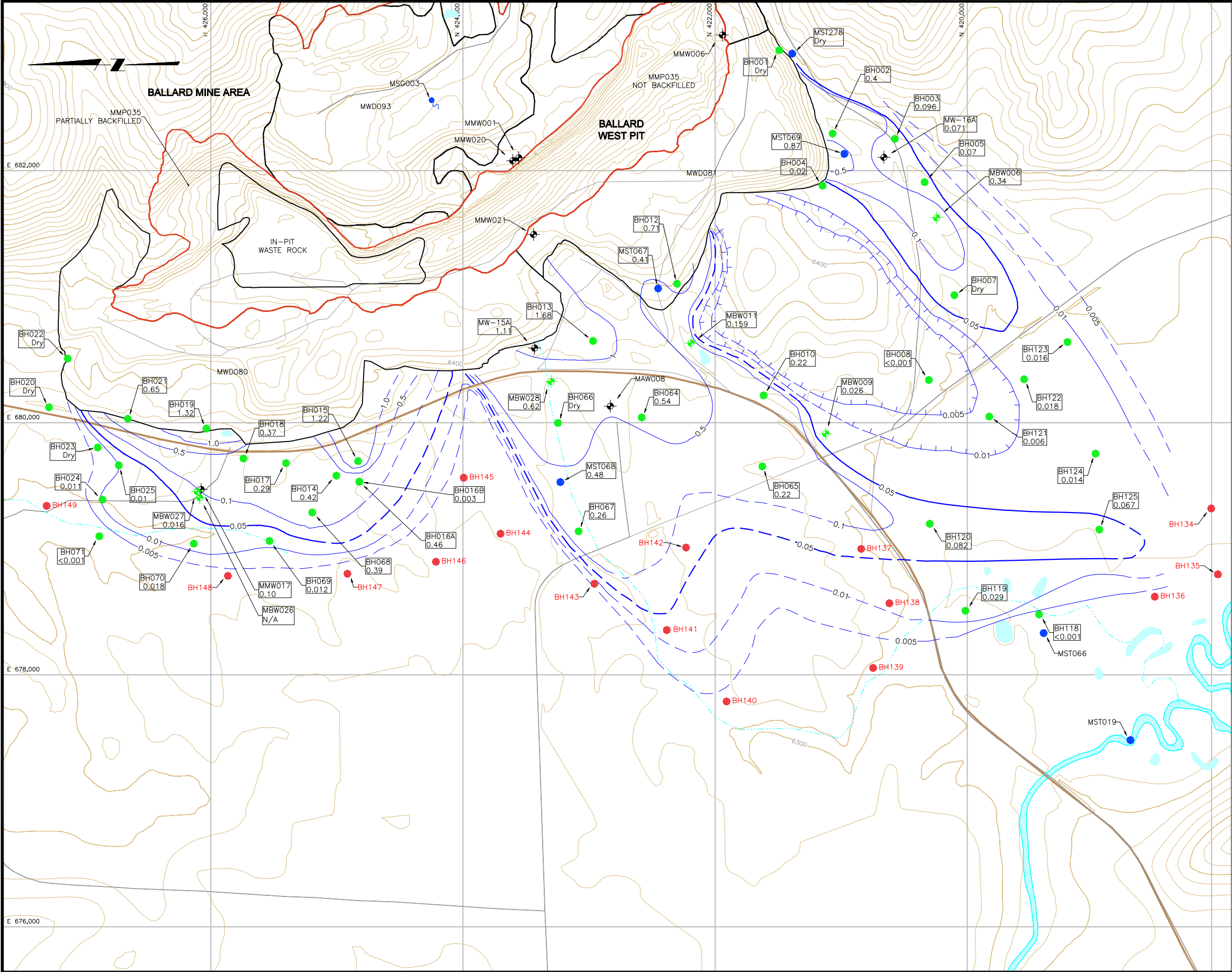


**LEGEND:**

NOTES:

BH = DIRECT-PUSH BOREHOLE  
MAW = AGRICULTURAL WELL  
MBW = DIRECT-PUSH MONITORING WELL  
MDW = DOMESTIC WELL  
MMP = MINE PIT  
MMW = MONITORING WELL  
MPW = PRODUCTION WELL  
MWD = WASTE ROCK DUMP  
MSG = SPRING STATION  
MSP = POND  
MST = STREAM STATION

[illegible]



LEGEND:

7000

POST-MINE CONTOUR & ELEVATION, FEET

POND OR LAKE

STREAM - PERENNIAL

STREAM - INTERMITTENT

MINE PIT LOCATION

WASTE ROCK PILE LOCATION

HIGHWAY

ROAD

RAILROAD

P4 PRODUCTION HAUL ROAD (ACTIVE & INACTIVE)

0.05

TOTAL SELENIUM ISOCONCENTRATION CONTOUR (mg/L)

0.05

INFERRED TOTAL SELENIUM ISOCONCENTRATION CONTOUR (mg/L)

GROUNDWATER MONITORING WELL LOCATION

DIRECT-PUSH MONITORING WELL INSTALLED IN 2008

PROPOSED APPROXIMATE 2009 DIRECT-PUSH BOREHOLE LOCATION

2008 DIRECT-PUSH BOREHOLE LOCATION

SPRING STATION

STREAM STATION

DIRECT PUSH, ALLUVIAL WELL, SPRING OR HEADWATER STREAM LOCATION WITH 2008 TOTAL SELENIUM CONCENTRATION IN mg/L

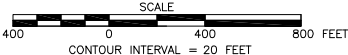
NOTES:

1. WHERE WELLS ARE NESTED IN THE ALLUVIAL FLOW SYSTEM (I.E. SHALLOW AND DEEPER) THE HIGHEST MEASURED CONCENTRATION IS USED FOR CONTOURING.

2. SPRING 2008 TOTAL SELENIUM CONCENTRATIONS ARE USED FOR MONITORING WELLS, SPRINGS AND HEADWATER STREAMS WHERE APPROPRIATE.

ISOCONCENTRATION CONTOUR INTERVAL=LOG WITH SUPPLEMENTAL HALF CYCLE CONTOURS.

BH = DIRECT-PUSH BOREHOLE  
MAW = AGRICULTURAL WELL  
MBW = DIRECT-PUSH MONITORING WELL  
MMP = MINE PIT  
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B	DRAFT	CHF	CLF	04/30/09															
A	DRAFT	CHF	CLF	03/25/09															
ISSUE	REV	DESCRIPTION		TECH	ENG	DATE													

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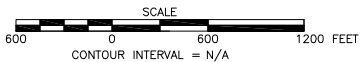
#### LEGEND:

- MINE PIT LOCATION
- WASTE ROCK PILE LOCATION
- WASTE ROCK PILE LOCATION OR PIT BACKFILL (APPROXIMATE)
- GROUNDWATER MONITORING WELL LOCATION
- DIRECT-PUSH MONITORING WELL INSTALLED IN 2008
- PROPOSED APPROXIMATE 2009 DIRECT-PUSH BOREHOLE LOCATION
- 2008 DIRECT-PUSH BOREHOLE LOCATION
- SPRING STATION
- STREAM STATION
- DIRECT-PUSH INVESTIGATION AREA
- DIRECT-PUSH BOREHOLE ID AND 2008 SELENIUM CONCENTRATION

#### NOTES:

1. RESULTS ARE FOR GRAB GROUNDWATER SAMPLES AND ARE DISSOLVED CONCENTRATIONS OF SELENIUM IN mg/L.

- BH = DIRECT-PUSH BOREHOLE
- MAW = AGRICULTURAL WELL
- MBW = DIRECT-PUSH MONITORING WELL
- MDW = DOMESTIC WELL
- MMP = MINE PIT
- MMW = MONITORING WELL
- MPW = PRODUCTION WELL
- MWD = WASTE ROCK DUMP
- MSP = POND



ISSUE	REV	DESCRIPTION	TECH	ENG	DATE
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DESIGNED BY	C.FOULK	04/30/09
DRAWN BY	E.MARKS	04/30/09
CHECKED BY	C.FOULK	04/30/09
APPROVED BY	C.FOULK	04/30/09
PROJECT MANAGER	C.FOULK	04/30/09
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

#### P4 PRODUCTION SITE INVESTIGATION

PROJECT LOCATION	BALLARD, HENRY AND ENOCH VALLEY MINES
PROJECT	2009 DIRECT-PUSH SAMPLING AND ANALYSIS PLAN
TITLE	LOCATION OF DIRECT-PUSH BOREHOLES HENRY MINE SOUTH

SHEET	6 of 8	REVISION	B
FILE NAME	1005813D133		





**LEGEND:**

- MINE PIT LOCATION
- WASTE ROCK PILE LOCATION
- WASTE ROCK PILE LOCATION OR PIT BACKFILL (APPROXIMATE)
- MMW002 GROUNDWATER MONITORING WELL LOCATION
- MBW009 DIRECT-PUSH MONITORING WELL INSTALLED IN 2008
- PROPOSED APPROXIMATE 2009 DIRECT-PUSH BOREHOLE LOCATION
- 2008 DIRECT-PUSH BOREHOLE LOCATION
- SPRING STATION
- STREAM STATION
- DIRECT-PUSH INVESTIGATION AREA
- DIRECT-PUSH BOREHOLE ID AND 2008 SELENIUM CONCENTRATION

**NOTES:**

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						DRAWN BY E.MARKS 04/30/09					PROJECT 2009 DIRECT-PUSH SAMPLING AND ANALYSIS PLAN			
						CHECKED BY C.FOULK 04/30/09					TITLE LOCATION OF DIRECT-PUSH BOREHOLES		SHEET 8 of 8	
						APPROVED BY C.FOULK 04/30/09					ENOCH VALLEY MINE SOUTH		REVISION B	
						PROJECT MANAGER C.FOULK 04/30/09					FILE NAME 1005813D132			
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**APPENDIX A**  
**STANDARD OPERATING PROCEDURES**  
**(Geoprobe® Systems)**

**APPENDIX B**  
**ASTM DOCUMENTS**



Designation: D 6001 – 05

## Standard Guide for Direct-Push Ground Water Sampling for Environmental Site Characterization<sup>1</sup>

This standard is issued under the fixed designation D 6001; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

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Designation: D 6282 – 98 (Reapproved 2005)

## Standard Guide for Direct Push Soil Sampling for Environmental Site Characterizations<sup>1</sup>

This standard is issued under the fixed designation D 6282; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

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Designation: D 6725 – 04

## Standard Practice for Direct Push Installation of Prepacked Screen Monitoring Wells in Unconsolidated Aquifers<sup>1</sup>

This standard is issued under the fixed designation D 6725; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

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**PART 3 – AGENCIES AND TRIBES COMMENTS AND P4  
COMMENT RESPONSES**



STATE OF IDAHO  
DEPARTMENT OF  
ENVIRONMENTAL QUALITY

444 Hospital Way, #300 • Pocatello, Idaho 83201 • (208) 236-6160

C.L. "Butch" Otter, Governor  
Toni Hardesty, Director

22 April 2009

Mr. Barry Koch  
Special Projects Lead - Mining  
P4 Production, LLC  
PO Box 816  
Soda Springs, ID 83276-0816

Re: *Direct Push Groundwater Continuation Sampling and Analysis Plan, Revision 0*,  
April 2009

Dear Mr. Koch,

The Agencies and Tribes have reviewed the *Direct Push Groundwater Continuation Sampling and Analysis Plan, Revision 0*, April 2009, (*DPSAP*) submitted by P4/Monsanto pursuant to Consent Order/Administrative Order on Consent, EPA Docket No. CERCLA-10-2003-0117 (CO/AOC). The plan appears to be consistent with previous comments by the Agencies and Tribes and their discussions with P4/Monsanto for this upcoming phase of the investigation. Agency/Tribal comments on the *DPSAP* are provided below.

The *Direct Push Groundwater Continuation Sampling and Analysis Plan, Revision 0*, April 2009, is considered a deliverable under the CO/AOC, and per Section 9.7 of the CO/AOC, "Within thirty (30) days of P4's receipt of the comment from IDEQ on each draft document, P4 shall amend and submit a revised document to IDEQ that incorporates all comments and corrects all deficiencies identified by IDEQ, unless such comments have been revised or withdrawn in writing." In observance of our review process, I will schedule time on the Monday, 4 May 2009, conference call to answer any questions you might have on the Agency/Tribal comments. Subsequently, the next version of the *Direct Push Groundwater Continuation Sampling and Analysis Plan* is due no later than 3 June 2009.

The CO/AOC clearly states that all deliverables shall be submitted in draft form, and are subject to review, comment, and written approval or disapproval by IDEQ. For each draft document, P4/Monsanto shall amend and submit a revised document to IDEQ that incorporates all comments and corrects all deficiencies. Should P4/Monsanto decide not to comply with the comments provided by IDEQ on behalf of all the Agencies and Tribes, discussions to resolve those issues should be initiated. However, after the

Agencies and Tribes have reviewed P4/Monsanto's position and issued instructions to P4/Monsanto to incorporate the original comments, P4/Monsanto must comply or initiate dispute resolution. Future deliverables will be deemed deficient and disapproved should P4/Monsanto fail to comply with the CO/AOC regarding incorporation of Agency/Tribal comments and stipulated penalties may be initiated from the date the revised deliverable was due.

Please let me know if you have any questions. I can be reached at 208.236.6160 or electronically at [michael.rowe@deq.idaho.gov](mailto:michael.rowe@deq.idaho.gov).

Sincerely,

A handwritten signature in black ink that reads "Mike Rowe". The signature is written in a cursive, flowing style.

Mike Rowe  
Regional Mining Project Manager

Enclosure

cc: Robert Geddes (P4/Monsanto)  
Cary Foulk (MWH)  
Doug Tanner, Bruce Olenick (IDEQ)  
Jeff Jones, Mary Kauffman, (C-TNF)  
Jason Sturm (BLM)  
Allen Ruberry (IDL)  
Kelly Wright (Shoshone-Bannock Tribes)  
Sandi Arena (USFWS)  
Dave Tomten (EPA)  
Bill Wiley (BIA)  
File copy/Monsanto/Correspondence

Agencies and Tribes Comments on  
*Direct Push Groundwater Continuation Sampling and Analysis Plan,*  
*Revision 0, April 2009*  
22 April 2009

***General Comments***

The following comments are from the 14 April 2009 meeting between P4/Monsanto, MWH, and the Agencies and Tribes that included discussion on surface water sampling for 2009 and 2010 and that relate directly to the direct push (DP) investigation.

0-A. Ballard – East Side. More boreholes are needed to confirm isopleths to the east of MWD084.

0-B. Ballard – East Side. A borehole will be added to the southwest of the proposed location for borehole BH133.

0-C. Henry – south portion. P4/Monsanto will do reconnaissance in the area around MST057 and MST276 to see if direct push investigation is possible. If so, boreholes will be sited to help identify possible selenium sources (e.g., Henry Mine, Rhodia's Wooley Valley Mine) that contribute to high levels at MST057 and MST276.

Additional comments

0-D. The Quality Assurance Project Plan (QAPP) and QAPP Addendum are referenced appropriately and need no further detail or discussion.

***Specific Comments***

0-1. Page i(?), paragraph 1. Reword this sentence as it is confusing. One alternative is, "This Sampling and Analysis Plan (SAP) describes continued environmental investigation activities and procedures, which P4 Production (P4) will use to conduct 2009 direct push investigations at Ballard, Henry, and Enoch Valley mines.

***Field Sampling Plan***

0-2. Section 2.0, page 2. As discussed during the 14 April 2009 meeting between P4/Monsanto, MWH, Agencies, and Tribes in Pocatello, additional DP boreholes are needed to better define the nature and extent of the selenium plume in the alluvium east of the Ballard Mine waste dump MWD084. The text should be expanded to include these additional DP boreholes.

0-3. Section 2.0, page 2, last paragraph. At this point in the investigation, it is presumptive to conclude that these DP boreholes will "... finish the nature and extent

characterization in the shallow alluvial aquifers.” The text should be revised to indicate that the investigation is ongoing and this phase of drilling has the potential to complete the nature and extent characterization for some or all shallow alluvial areas of interest.

0-4. Section 3.1, page 3, Step 2, bullet 1. Revise text to note that while Regional background levels have not been conclusively established for groundwater or surface water, they appear to be near the limits of quantification. Add text to note that goals of the study include characterizing the nature and extent of Se contamination in shallow alluvium. Understanding nature and extent is needed to support risk characterization, and to understand potential for groundwater to cause or contribute to violations of compliance thresholds in interconnected surface water.

0-5. Section 3.1, page 3, Step 3, bullet 1. The discussion on sources of data is limited to groundwater monitoring wells. The bullet should be revised to include surface water expressions of groundwater as available groundwater monitoring points for characterization of the shallow aquifer selenium plumes. Add text noting that additional secondary information inputs may include hydrogeologic factors, flow rates, distance to nearby surface water discharge areas, concentrations relative to compliance thresholds and background, and other factors.

0-6. Section 3.1, page 3, Step 4, bullet 1. This bullet is new (not included in the 2008 DP workplan) and should be shown in italics. Add text indicating that hydrogeologic factors may be used to define the boundaries of the study.

0-7. Section 3.1, page 4, Step 5, bullet 3. The term “decision error lower bound” needs to be defined in the document, either in the DQOs or in another appropriate section of the SAP. Also, it is unclear what is meant by exceeding the decision error lower bound (i.e., 0.017 mg/L of Se). Does 0.016 mg/L of Se or 0.018 mg/L of Se “exceed” the decision error lower bound? Please note that we believe best professional judgment must be factored into the analytic approach, and that it is not appropriate to rely solely on a selected “lower bound” value. Best professional judgment would allow consideration of flow direction and rate, and distance to surface water discharge areas. Please reword this bullet to address the above.

0-8. Section 3.1, page 4, Step 6, bullet 2. The purpose of Step 6 should be to specify performance goals and/or approaches for choosing between alternative actions. In accomplishing this, P4/Monsanto appears to have established a lower bound value for selenium of 0.017 mg/L. However, the explanation of the source, rationale, and application of this value is unclear and confusing. Please clarify. Also, revise the text to explain that decision criteria will not be based solely on a lower bound value, and that other factors (such as those noted in comments above) may be considered.

0-9. Section 3, page 4, Step 7, bullet 1. At this point in the investigation, it is presumptive to state: “This direct push field sampling plan was developed to complete the contaminant extent characterization in select areas not delineated during the 2008 investigation.” The bullet should be revised to indicate that the field sampling plan was

developed to continue ongoing characterization of the nature and extent of the selenium plumes in the shallow aquifers. This effort may complete the investigation of the shallow alluvial system, but such conclusions can only be made following the assessment of data.

0-10. Section 5.1, page 7. In Bullet Number 3, it says that primary and equipment rinsate sample numbers will start with 001 and go up to 299, if required. In the next paragraph, the example of a blind duplicate sample label is BallardE-GW300. Yet on the next page it says blind duplicate and rinsate sample numbers will start at '400' and go up from there. Please reconcile.

0-11. Section 6.0, page 9, paragraph 1, last sentence. You seem to imply that you are awaiting additional data from 2008 to help determine distribution of boreholes. What additional information is needed from the 2008 data that you currently do not have?

0-12. Section 6.9, page 13, paragraph 1. Rephrase the third sentence as it is confusing. One option is, "After collection, samples will be properly stored to prevent degradation of the integrity of the sample prior to its analysis. Samples will be analyzed within the prescribed holding time."

### *Drawings*

#### Ballard Mine

0-13. Drawings 2 and 3, Area E. The proposed DP locations for Area E appear to be appropriate with the following exception:

- As discussed during the 14 April 2009 meeting between P4/Monsanto, MWH, Agencies, and Tribes in Pocatello, DP borehole locations should be added to better define the extent of the selenium plume east of Ballard Mine MWD084.
  - Additional investigation is needed between MST093 and BH054 to better define the northern edge of the selenium plume.
  - Additional investigation is needed northeast of BH052, BH053, and BH054 to determine if the plume actually crosses the adjoining local drainage channel, as depicted in Drawing 3.

0-14. Drawings 4 and 5, Area E. The proposed DP locations for Areas F and G appear to be appropriate with the following exception:

- As discussed during the April 14 April 2009 meeting between P4/Monsanto, MWH, Agencies, and Tribes in Pocatello, add and/or move DP borehole locations to better define the extent of the selenium plume west of Ballard Mine MWD080 in the area between and west of BH016 and BH067.

#### Henry

0-15. No new DP locations were proposed for Area C at Henry Mine and no drawings were provided. However, as discussed during the 14 April 2009 meeting between P4/Monsanto, MWH, Agencies, and Tribes in Pocatello, DP borehole locations should be added to better define the extent of the selenium plume east of MWD090. Add a drawing

showing at least two DP locations in the drainage east of MWD090, updrainage from MST064/MST276. The boreholes should be placed in a manner that will help differentiate potential impacts from the Henry and Wooley Valley mines to local groundwater and surface water.

0-16. Drawing 6, Area D. The Drawing shows three proposed approximate 2009 DP borehole locations, whereas the text on page 2 (Section 2) indicates that four to six DP boreholes will be drilled. Drawing 6 should show at least four approximated drilling locations.

### ***Editorial Comments***

Section 2.0, page 2, paragraph 2, line 5. Change *were* to where.

Section 2.0, page 2, paragraph 2, line 7. Change *need* to needed.

Section 3.1, page 4, Step 6, bullet 1, line 7. Change *collect* to collected.

Section 3.1, page 4, Step 6, bullet 3, line 5. Change *exceed* to exceeded.

Section 3.1, page 4, Step 7, bullet 2, line 5. This last sentence is incomplete as there appears to be a missing word after *applicable*.

Section 5.1, page 7, bullet number 3, line 3. Change *number* to numbered.

**Response to Agencies and Tribes Comments on  
*Direct Push Groundwater Continuation Sampling and Analysis Plan,*  
Revision 0, April 2009**

The following is P4 Production's (P4's) responses to the comments received from the Agencies and Tribes (A/T) on April 22, 2009 for the *Direct Push Groundwater Continuation Sampling and Analysis Plan*. Each A/T comment is listed followed by P4's response and an indication of how the text in the sampling and analysis plan was revised, where needed.

***General Comments***

The following comments are from the 14 April 2009 meeting between P4/Monsanto, MWH, and the Agencies and Tribes that included discussion on surface water sampling for 2009 and 2010 and that relate directly to the direct push (DP) investigation.

0-A. Ballard – East Side. More boreholes are needed to confirm isopleths to the east of MWD084.

Response: *Three addition boreholes have been added on the northern and eastern sides of the plume originating from MWD084 as shown on the revised Drawings 2 and 3.*

0-B. Ballard – East Side. A borehole will be added to the southwest of the proposed location for borehole BH133.

Response: *An additional borehole has been added at the location as requested as shown on the revised Drawings 4 and 5.*

0-C. Henry – south portion. P4/Monsanto will do reconnaissance in the area around MST057 and MST276 to see if direct push investigation is possible. If so, boreholes will be sited to help identify possible selenium sources (e.g., Henry Mine, Rhodia's Wooley Valley Mine) that contribute to high levels at MST057 and MST276.

Response: *A map for this area has been added to the work plan (Drawing 6) with the area to be investigated indicated.*

**Additional comments**

0-D. The Quality Assurance Project Plan (QAPP) and QAPP Addendum are referenced appropriately and need no further detail or discussion.

Response: *Acknowledged.*

### ***Specific Comments***

0-1. Page i(?), paragraph 1. Reword this sentence as it is confusing. One alternative is, “This Sampling and Analysis Plan (SAP) describes continued environmental investigation activities and procedures, which P4 Production (P4) will use to conduct 2009 direct push investigations at Ballard, Henry, and Enoch Valley mines.

*Response: The specific text has been revised to reflect this comment.*

### **Field Sampling Plan**

0-2. Section 2.0, page 2. As discussed during the 14 April 2009 meeting between P4/Monsanto, MWH, Agencies, and Tribes in Pocatello, additional DP boreholes are needed to better define the nature and extent of the selenium plume in the alluvium east of the Ballard Mine waste dump MWD084. The text should be expanded to include these additional DP boreholes.

*Response: The plan has been revised as discussed in the response to comment 0-A above.*

0-3. Section 2.0, page 2, last paragraph. At this point in the investigation, it is presumptive to conclude that these DP boreholes will “. . . finish the nature and extent characterization in the shallow alluvial aquifers.” The text should be revised to indicate that the investigation is ongoing and this phase of drilling has the potential to complete the nature and extent characterization for some or all shallow alluvial areas of interest.

*Response: The specific text has been revised to reflect this comment.*

0-4. Section 3.1, page 3, Step 2, bullet 1. Revise text to note that while Regional background levels have not been conclusively established for groundwater or surface water, they appear to be near the limits of quantification. Add text to note that goals of the study include characterizing the nature and extent of Se contamination in shallow alluvium. Understanding nature and extent is needed to support risk characterization, and to understand potential for groundwater to cause or contribute to violations of compliance thresholds in interconnected surface water.

*Response: Text has been added to reflect this comment.*

0-5. Section 3.1, page 3, Step 3, bullet 1. The discussion on sources of data is limited to groundwater monitoring wells. The bullet should be revised to include surface water expressions of groundwater as available groundwater monitoring points for characterization of the shallow aquifer selenium plumes. Add text noting that additional secondary information inputs may include hydrogeologic factors, flow rates, distance to nearby surface water discharge areas, concentrations relative to compliance thresholds and background, and other factors.

Response: *The specific text has been revised to reflect this comment.*

0-6. Section 3.1, page 3, Step 4, bullet 1. This bullet is new (not included in the 2008 DP workplan) and should be shown in italics. Add text indicating that hydrogeologic factors may be used to define the boundaries of the study.

Response: *The specific text has been italicized to reflect this comment and revised to reflect this comment.*

0-7. Section 3.1, page 4, Step 5, bullet 3. The term “decision error lower bound” needs to be defined in the document, either in the DQOs or in another appropriate section of the SAP. Also, it is unclear what is meant by exceeding the decision error lower bound (i.e., 0.017 mg/L of Se). Does 0.016 mg/L of Se or 0.018 mg/L of Se “exceed” the decision error lower bound? Please note that we believe best professional judgment must be factored into the analytic approach, and that it is not appropriate to rely solely on a selected “lower bound” value. Best professional judgment would allow consideration of flow direction and rate, and distance to surface water discharge areas. Please reword this bullet to address the above.

Response: *We concur with the comment relating to professional judgment and text has been added to the DQO to reflect this. For example, the same low concentration on the leading edge of the plume needs to be considered differently from the same value along the upgradient edge.*

*The decision error lower bound (DELB) is an effort to assign a value to which we are comfortable saying that the groundwater is not impacted by selenium at a level of concern given relatively limited data. Exceeding the DELB indicates that there is a possibility that at that location the compliance threshold may be exceeded. Below the DELB we are reasonably comfortable that the threshold is not being exceeded. Temporal trends of systematically increasing or decreasing concentrations are not considered (the direct-push program is a “snapshot”).*

*By way of further explanation, the groundwater compliance threshold of interest for selenium is 0.05 mg/L. We seek a value for which an observation can be confidently interpreted as being not in excess of the compliance threshold. Because each boring will be sampled once, we have one observation with which to estimate the mean (not a great estimate of the mean, we admit, but still an estimate). Our knowledge constraints about selenium concentration of alluvial groundwater in a particular boring are limited to: (1) an estimate of the mean (i.e., our single observation), and (2) a lower bound of zero, maximum entropy interference (a citation to which is provided in the draft plan). This suggests a default solution for the distribution of the variable of interest (selenium concentration in alluvial groundwater in the spring at the boring in question) be an exponential distribution.*

*It so happens that the 95<sup>th</sup> percentile of an exponential distribution is three times the mean. Thus, if we define our exponential distribution based on an observation that is no*

*less than one-third of 0.05 mg/L – i.e., 0.017 mg/L – we can be 95% confident that the boring in question does not have problematic levels of selenium.*

*The maximum entropy solution described in the plan is the most uncertain distribution that can possibly be defined given the knowledge constraints at hand, where the metric of uncertainty is the informational entropy of the distribution. By selecting the most uncertain distribution possible, P4 Production conservatively defines the DELB (consider this a decision or action threshold for determining whether alluvial groundwater at the location of interest is contaminated at a level of concern).*

*The text has been revised to more accurately and clearly explain this rationale. The previous text indicated that one half a logarithmic cycle was used as the DELB, which was not correct.*

0-8. Section 3.1, page 4, Step 6, bullet 2. The purpose of Step 6 should be to specify performance goals and/or approaches for choosing between alternative actions. In accomplishing this, P4/Monsanto appears to have established a lower bound value for selenium of 0.017 mg/L. However, the explanation of the source, rationale, and application of this value is unclear and confusing. Please clarify. Also, revise the text to explain that decision criteria will not be based solely on a lower bound value, and that other factors (such as those noted in comments above) may be considered.

*Response: Hopefully the explanation provided above in response to comment 0-7 is clearer than the draft text and provides sufficient rationale as to the use of the “decision error lower bound.” We shall modify the text to note that the DELB will not be a stand-alone decision criterion; we shall allow for professional judgment as noted in comment 0-7.*

0-9. Section 3, page 4, Step 7, bullet 1. At this point in the investigation, it is presumptive to state: “This direct push field sampling plan was developed to complete the contaminant extent characterization in select areas not delineated during the 2008 investigation.” The bullet should be revised to indicate that the field sampling plan was developed to continue ongoing characterization of the nature and extent of the selenium plumes in the shallow aquifers. This effort may complete the investigation of the shallow alluvial system, but such conclusions can only be made following the assessment of data.

*Response: The specific text has been revised to reflect this comment.*

0-10. Section 5.1, page 7. In Bullet Number 3, it says that primary and equipment rinsate sample numbers will start with 001 and go up to 299, if required. In the next paragraph, the example of a blind duplicate sample label is BallardE-GW300. Yet on the next page it says blind duplicate and rinsate sample numbers will start at ‘400’ and go up from there. Please reconcile.

*Response: The text has been revised to begin sample numbering at 400.*

0-11. Section 6.0, page 9, paragraph 1, last sentence. You seem to imply that you are awaiting additional data from 2008 to help determine distribution of boreholes. What additional information is needed from the 2008 data that you currently do not have?

Response: *The specific text has been revised to remove any text implying additional information is needed.*

0-12. Section 6.9, page 13, paragraph 1. Reword the third sentence as it is confusing. One option is, "After collection, samples will be properly stored to prevent degradation of the integrity of the sample prior to its analysis. Samples will be analyzed within the prescribed holding time."

Response: *The specific text has been reworded to reflect this comment.*

## **Drawings**

### **Ballard Mine**

0-13. Drawings 2 and 3, Area E. The proposed DP locations for Area E appear to be appropriate with the following exception:

- As discussed during the 14 April 2009 meeting between P4/Monsanto, MWH, Agencies, and Tribes in Pocatello, DP borehole locations should be added to better define the extent of the selenium plume east of Ballard Mine MWD084.
  - Additional investigation is needed between MST093 and BH054 to better define the northern edge of the selenium plume.
  - Additional investigation is needed northeast of BH052, BH053, and BH054 to determine if the plume actually crosses the adjoining local drainage channel, as depicted in Drawing 3.

Response: *Drawings 2 and 3 have been revised to show three additional boreholes to address that areas indicated in the comment.*

0-14. Drawings 4 and 5, Area E. The proposed DP locations for Areas F and G appear to be appropriate with the following exception:

- As discussed during the April 14 April 2009 meeting between P4/Monsanto, MWH, Agencies, and Tribes in Pocatello, add and/or move DP borehole locations to better define the extent of the selenium plume west of Ballard Mine MWD080 in the area between and west of BH016 and BH067.

Response: *An additional borehole has been added to infill the area indicated as show on the revised Drawings 4 and 5.*

### **Henry Mine**

0-15. No new DP locations were proposed for Area C at Henry Mine and no drawings were provided. However, as discussed during the 14 April 2009 meeting between P4/Monsanto, MWH, Agencies, and Tribes in Pocatello, DP borehole locations should be

added to better define the extent of the selenium plume east of MWD090. Add a drawing showing at least two DP locations in the drainage east of MWD090, updrainage from MST064/MST276. The boreholes should be placed in a manner that will help differentiate potential impacts from the Henry and Wooley Valley mines to local groundwater and surface water.

*Response: A new drawing showing Area C has been added to the set. The locations shown are tentative pending a reconnaissance of the area.*

0-16. Drawing 6, Area D. The Drawing shows three proposed approximate 2009 DP borehole locations, whereas the text on page 2 (Section 2) indicates that four to six DP boreholes will be drilled. Drawing 6 should show at least four approximated drilling locations.

*Response: A fourth borehole has been added in the area as shown on the revised drawing.*

### ***Editorial Comments***

Section 2.0, page 2, paragraph 2, line 5. Change *were* to where.

Section 2.0, page 2, paragraph 2, line 7. Change *need* to needed.

Section 3.1, page 4, Step 6, bullet 1, line 7. Change *collect* to collected.

Section 3.1, page 4, Step 6, bullet 3, line 5. Change *exceed* to exceeded.

Section 3.1, page 4, Step 7, bullet 2, line 5. This last sentence is incomplete as there appears to be a missing word after *applicable*.

Section 5.1, page 7, bullet number 3, line 3. Change *number* to numbered.

*Response: All editorial comments have been incorporated.*



STATE OF IDAHO  
DEPARTMENT OF  
ENVIRONMENTAL QUALITY

444 Hospital Way, #300 • Pocatello, Idaho 83201 • (208) 236-6160

C.L. "Butch" Otter, Governor  
Toni Hardesty, Director

12 May 2009

Mr. Barry Koch  
Special Projects Lead - Mining  
P4 Production, LLC  
PO Box 816  
Soda Springs, ID 83276-0816

Re: *Direct Push Groundwater Continuation Sampling and Analysis Plan, Revision 1*,  
April 2009

Dear Mr. Koch,

The Agencies and Tribes have reviewed the *Direct Push Groundwater Continuation Sampling and Analysis Plan, Revision 1*, April 2009, (*DPSAP*) submitted by P4/Monsanto pursuant to Consent Order/Administrative Order on Consent, EPA Docket No. CERCLA-10-2003-0117 (CO/AOC). P4/Monsanto's *Response to Agencies and Tribes Comments on Direct Push Groundwater Continuation Sampling and Analysis Plan, Revision 0*, dated 30 Apr 09, appears to be complete and no specific responses are necessary with the exception of Specific Comment No. 0-7, whose subject is the proposed decision error lower bound (DELB) estimate. Any discussion of the DELB is fully relevant to Data Quality Objectives Steps 5 and 6 of the Field Sampling Plan, so comments on the DELB have been placed in both steps. Otherwise, the *DPSAP* appears to be consistent with previous Agency/Tribal comments and discussions with P4/Monsanto with only slight revision. The Agencies and Tribes conditionally approve Revision 1 of the *Direct Push Groundwater Continuation Sampling and Analysis Plan* so field work can begin. Final approval will be contingent upon addressing our remarks in regard to the DELB and other minor comments provided below.

The Agencies and Tribes look forward to finalizing this document. Please let me know if you have any questions.

Sincerely,

A handwritten signature in black ink that reads "Mike Rowe". The signature is fluid and cursive, with the first name "Mike" being more prominent than the last name "Rowe".

Mike Rowe  
Regional Mining Project Manager

Enclosure

cc:	Robert Geddes (P4/Monsanto)	Sandi Arena (USFWS)
	Cary Foulk (MWH)	Dave Tomten (EPA)
	Doug Tanner, Bruce Olenick (IDEQ)	Bill Wiley (BIA)
	Jeff Jones, Mary Kauffman (C-TNF)	File copy/Monsanto/ Correspondence
	Jason Sturm (BLM)	
	Allen Ruberry (IDL)	
	Kelly Wright (Shoshone-Bannock Tribes)	

Agencies and Tribes Comments on  
*Direct Push Groundwater Continuation Sampling and Analysis Plan,*  
*Revision 1, April 2009*  
8 May 2009

***General Comments***

1-A. Change Draft QAPP Addendum to Final QAPP Addendum as the Agencies and Tribes have now approved it.

1-B. Language should be added to the SAP allowing for unanticipated, additional direct push (DP) boreholes to be drilled.

***Specific Comments***

1-1. Page i(?), paragraph 4, line 1. PgmQAP has not been defined. Would QAPP suffice here?

***Field Sampling Plan***

1-2. Section 2.0, page 2, indent 3. As shown on Drawing 6 and Table 1, the text should mention that two direct push (DP) borehole locations will be added in the drainage east of MWD090, upstream from MST064/MST276, at Henry Mine. These boreholes will be placed in a manner that will help differentiate potential impacts from the Henry and Wooley Valley mines to local groundwater and surface water.

1-3. Section 3.0, page 3, paragraph 2. There are five remaining areas yet to be defined to a level satisfactory for decision making. The text should mention the drainage east of MWD090 at southern Henry Mine.

1-4. Section 3.1, page 4, bullet 1. This additional bullet to DQO Step 3 should be italicized to reflect the addition.

1-5. Section 3.1, page 4, Step 4, bullet 3. The text should mention the drainage east of MWD090.

1-6. Section 3.1, page 4, Step 5. We agree with the basic concept of establishing a criterion such as the decision error lower bound (DELB) to be used to determine, along with other factors, if further direct-push sampling may be required. However, further clarification is needed on how the DELB will be applied. For example, P4/Monsanto states:

“If shallow groundwater selenium concentration exceeds decision error lower bound (DELB), then further direct-push sampling may be required, otherwise the selenium plume is considered bound by the direct-push location.”

and

“Professional judgment also needs to be utilized in the evaluation of the data to account for hydrogeologic and other factors.”

We recognize that it is impractical to establish a detailed methodology for deciding when and where to require additional direct push sample locations based on a single criterion such as a DELB. As P4/Monsanto states in the fourth bullet of Step 5, professional judgment will be a key factor along with “hydrogeologic and other factors.” Therefore, for the purpose of clarification, the fourth bullet of Step 5 should be expanded to include a list of key factors that may drive decisions for additional direct push sampling. Several of these factors are discussed in Step 6, but must be listed under Step 5 as potential decision factors, including:

- Variability due to sampling or analytical error.
- Proximity to surface water
- Groundwater discharge to surface water
- Concentration trends in nearby monitoring wells

Other factors were not mentioned in Step 6 but may also affect deciding when and where additional direct push sample locations will be required. Other factors that may affect decisions for additional direct push sample locations include, but are not limited to:

- Spatial coverage of the direct push samples
- Proximity of the direct push samples to the potential source area
- Proximity to property boundaries
- Proximity to a surface water body
- Natural background concentrations

Revise the text in DQO Step 5 to add the decision factors listed above.

1-7. Section 3.1, page 4, Step 6. In the 1<sup>st</sup> sentence of the 1<sup>st</sup> bullet of DQO Step 6, P4/Monsanto states:

“Given that the goal defining the extent of groundwater impacts above the groundwater standard of 0.05 mg/L and the direct-push reconnaissance methods from groundwater sampling, a large lower bound needs to be considered above which the groundwater may be considered potentially impacted in relation to the groundwater standard.”

The phrase “. . . a large lower bound needs to be considered . . .” is not appropriate because the word “large” infers that the lower bound may not be adequately conservative

or protective. The word “large” should be deleted. The first use of the word “considered” should also be replaced since it leads to some ambiguity with respect to P4/Monsanto’s intent to establish a lower bound to base decisions. Revise the statement as follows:

“Given that the goals include generally defining nature and extent of contamination and defining the extent of groundwater impacts above the groundwater standard of 0.05 mg/L, and considering the direct-push reconnaissance methods for groundwater sampling, it may be useful to establish a protective lower bound above which the groundwater may be considered potentially impacted in relation to the groundwater standard.” The observed concentration in groundwater relative to a lower bound, along with other factors, would be used to make decisions on whether to continue stepping out to define nature and extent of contamination.

1-8. Section 3.1, page 4, Step 6. Also in Step 6, P4/Monsanto has attempted to set a DELB at a value that is reasonably conservative in determining if the groundwater is impacted by selenium, given the relatively limited data. P4/Monsanto’s proposed DELB value is 0.017 mg/L, which may or may not prove to be appropriately conservative. Revise the text regarding assumptions and statistical basis for the selection of this value based on the following information and discussion.

Defining a DELB is dependent on professional judgment assumptions. P4/Monsanto’s assumptions appear to be as follows:

- 1) The data may be distributed in a relatively skewed distribution such as an exponential distribution.
- 2) A single value should be considered as an estimate of the mean.
- 3) The percentages of exceedances of the groundwater compliance threshold value should be restricted to 5% (by equating the estimated 95<sup>th</sup> percentile of the selenium concentrations to 0.05 mg/L).

We generally concur with the first and third assumptions. Choosing the exponential distribution and setting the 95<sup>th</sup> percentile of the selenium concentration at 0.05 mg/L does provide a relatively conservative basis.

For the second assumption, however, the A/T do not believe that treating an individual concentration as an estimate of the mean is the best representation of that information. Instead, a DELB should be selected based on the calculated probability that individual measured concentrations would fall below a threshold concentration. In Table 1, this relationship is shown for various concentrations for a distribution with the estimated 95<sup>th</sup> percentile of selenium values of 0.05 mg/L. From this table, for instance, it can be seen that, for the expected mean value of 0.017, 63.9% of individual values are expected to be at or below 0.017. Note that a value approximately midway between 0.011 mg/L and 0.012 mg/L would serve as an estimate of the 50<sup>th</sup> percentile (median) of the population.

**TABLE 1****Exponential Distribution with a 95<sup>th</sup> Percentile of 0.05 mg/L**

<b>Concentration (mg/L)</b>	<b>Proportion of Individual Concentrations Expected to be Less Than or Equal to the Concentration</b>
0.005	0.259
0.006	0.302
0.007	0.343
0.008	0.381
0.009	0.417
0.010	0.451
0.011	0.483
0.012	0.513
0.013	0.542
0.014	0.568
0.015	0.593
0.016	0.617
0.017	0.639
0.018	0.660
0.019	0.680
0.020	0.699
0.021	0.716
0.022	0.733
0.023	0.748
0.024	0.763
0.025	0.777
0.050	0.950

Based on the preceding discussion, it is apparent that the statistical calculation of the DELB can yield a great range of threshold concentrations depending on professional judgment and the assumptions made. Therefore, please revise and document DQO Step 6 consistent with the preceding comments. At a minimum, revisions to Step 6 should include the following:

- Select a DELB value based on the proportion of concentrations expected to fall at or below some given level where the given level will have to be based on best professional judgment and as approved by the A/T. The A/T view this as an improved interpretation of the statistics rather than referring to a single value as an estimate of the mean, since a single value is a relatively poor estimate of the mean.
- Revise or delete presumptions of “confidence” in Step 6, as reflected in the statement “*we can be 95% confident that the boring in question does not have problematic levels of selenium.*” We believe this is too strong a statement because of the judgment required to define the assumptions, which then plays a huge part in which level is recommended as the DELB. For example, the proposed DELB would have been substantially lower if P4/Monsanto had considered a more conservative distribution,

such as one based on an estimated 99<sup>th</sup> percentile set at 0.05 mg/L. In this case, the estimated mean of the population would drop from 0.017 mg/L to 0.007 mg/L. For the expected mean value of 0.007 mg/L, an expected proportion of 63.2% of individual values would be at or below 0.007 mg/L and a value of approximately 0.005 mg/L would serve as an estimate of the 50<sup>th</sup> percentile (median) of the population.

- Provide sufficient justification for a 95<sup>th</sup> percentile concentration set at 0.05 mg/L versus a more conservative value such as the 99<sup>th</sup> or 99.9<sup>th</sup> percentile.

It is important to emphasize that the intent of the preceding discussion should not be interpreted as a rejection of a DELB value of 0.017 mg/L. The expected mean of 0.017 mg/L may be appropriate. Instead the A/T are saying that the DELB must be based on a more appropriate statistical analysis, as described above. We also want to emphasize that use of a DELB is only one of several factors that must be considered when making decisions on drilling additional wells. In some cases, for instance, additional DP locations may prove necessary to define a plume in an area where other factors, such as natural background conditions, spatial coverage, and proximity to a source, property boundary, or surface waterbody, become key factors in making decisions.

1-9. Section 4.0, page 7, Table 1. Label the columns.

### ***Editorial Comments***

General: Be consistent, use direct push or direct-push, but not both.

Section 2.0, page 2, paragraph 2, line 7. Change *need* to needed.

Section 3.1, page 4, Step 6, bullet 2, line 8. Delete *need*.

Section 5.1, page 8, number 3. Would you be better off saying (e.g., 158) rather than (*i.e.*, 143) considering that based on Table 1 the last borehole at this time is BH158?

Section 5.1, page 8, paragraph 2, line 3. This should be BallardE-GW400 rather than *BallardE-GW300*, if blind duplicate and rinsate sample numbers start at 400.

**Agencies and Tribes 8 May 2009 Comments on  
Direct Push Groundwater Continuation Sampling and Analysis Plan,  
Revision 1, April 2009**

**Revised after Agencies and Tribes review on June 10, 2009 in response to an e-mail from  
Mike Rowe dated June 4, 2009 sent to Cary Foulk and Barry Koch**

***General Comments***

1 -A. Change Draft QAPP Addendum to Final QAPP Addendum as the Agencies and Tribes have now approved it.

Response: *The text has been revised as indicated.*

1-B. Language should be added to the SAP allowing for unanticipated, additional direct push (DP) boreholes to be drilled.

Response: *Text has been added as indicated to Step 4 of the DQOs (Section 3.1). In addition, text indicating the possibility of additional direct-push boreholes was already contained in the first paragraph of Section 4.0.*

***Specific Comments***

1-1. Page i(?), paragraph 4, line 1. PgmQAP has not been defined. Would QAPP suffice here?

Response: *PgmQAP has been changed to QAPP.*

***Field Sampling Plan***

1-2. Section 2.0, page 2, indent 3. As shown on Drawing 6 and Table 1, the text should mention that two direct push (DP) borehole locations will be added in the drainage east of MWD090, upstream from MST064/MST276, at Henry Mine. These boreholes will be placed in a manner that will help differentiate potential impacts from the Henry and Wooley Valley mines to local groundwater and surface water.

Response: *The text has been revised as suggested.*

1-3. Section 3.0, page 3, paragraph 2. There are five remaining areas yet to be defined to a level satisfactory for decision making. The text should mention the drainage east of MWD090 at southern Henry Mine.

Response: *The text has been revised as suggested.*

1-4. Section 3.1, page 4, bullet I. This additional bullet to DQO Step 3 should be italicized to reflect the addition.

Response: *The text has been revised as suggested.*

1-5. Section 3.1, page 4, Step 4, bullet 3. The text should mention the drainage east of MWD090.

Response: *The text has been revised as suggested.*

**Note: the following comment and comment response (1-6 through 1-8) were reviewed by A/T, and the A/T responded in an e-mail received from Michael Rowe, IDEQ, on June 4, 2009. The A/T and P4 slightly disagree on the statistics underlying the determination of the DELB discussed in comments 1-6 through 1-8. However, the A/T proposed a compromise that is acceptable to both P4 and the A/T. The text proposed by the A/T in the e-mail is incorporated into the FSP. Other portions of the following comments have been incorporated in the FSP text as appropriate. A copy of the June 4 e-mail is attached to this comment response document.**

1-6. Section 3.1, page 4, Step 5. We agree with the basic concept of establishing a criterion such as the decision error lower bound (DELB) to be used to determine, along with other factors, if further direct-push sampling may be required. However, further clarification is needed on how the DELB will be applied. For example, P4/Monsanto states:

"If shallow groundwater selenium concentration exceeds decision error lower bound (DELB), then further direct-push sampling may be required, otherwise the selenium plume is considered bound by the direct-push location."

and

"Professional judgment also needs to be utilized in the evaluation of the data to account for hydrogeologic and other factors."

We recognize that it is impractical to establish a detailed methodology for deciding when and where to require additional direct push sample locations based on a single criterion such as a DELB. As P4/Monsanto states in the fourth bullet of Step 5, professional judgment will be a key factor along with "hydrogeologic and other factors." Therefore, for the purpose of clarification, the fourth bullet of Step 5 should be expanded to include a list of key factors that may drive decisions for additional direct push sampling. Several of these factors are discussed in Step 6, but must be listed under Step 5 as potential decision factors, including:

- Variability due to sampling or analytical error.

- Proximity to surface water
- Groundwater discharge to surface water
- Concentration trends in nearby monitoring wells

Other factors were not mentioned in Step 6 but may also affect deciding when and where additional direct push sample locations will be required. Other factors that may affect decisions for additional direct push sample locations include, but are not limited to:

- Spatial coverage of the direct push samples
- Proximity of the direct push samples to the potential source area
- Proximity to property boundaries Proximity to a surface water body
- Natural background concentrations

Revise the text in DQO Step 5 to add the decision factors listed above.

Response: *We completely agree with the A/T suggestion, and have incorporated the suggested text into the DQOs.*

1-7. Section 3.1, page 4, Step 6. In the 1" sentence of the 1" bullet of DQO Step 6, P41Monsanto states:

"Given that the goal defining the extent of groundwater impacts above the groundwater standard of 0.05 mg/L and the direct-push reconnaissance methods from groundwater sampling, a large lower bound needs to be considered above which the groundwater may be considered potentially impacted in relation to the groundwater standard."

The phrase ". . . a large lower bound needs to be considered. . ." is not appropriate because the word "large" infers that the lower bound may not be adequately conservative or protective. The word "large" should be deleted. The first use of the word "considered" should also be replaced since it leads to some ambiguity with respect to P4/Monsanto's intent to establish a lower bound to base decisions. Revise the statement as follows:

"Given that the goals include generally defining nature and extent of contamination and defining the extent of groundwater impacts above the groundwater standard of 0.05 mg/L, and considering the direct-push reconnaissance methods for groundwater sampling, it may be useful to establish a protective lower bound above which the groundwater may be considered potentially impacted in relation to the groundwater standard." The observed concentration in groundwater relative to a lower bound, along with other factors, would be used to make decisions on whether to continue stepping out to define nature and extent of contamination.

Response: *The text provided above has been incorporated into the document.*

1-8. Section 3.1, page 4, Step 6. Also in Step 6, P4/Monsanto has attempted to set a DELB at a value that is reasonably conservative in determining if the groundwater is impacted by selenium, given the relatively limited data. P4/Monsanto proposed DELB value is 0.017 mg/L, which may or may not prove to be appropriately conservative. Revise the text regarding assumptions and statistical basis for the selection of this value based on the following information and discussion.

Defining a DELB is dependent on professional judgment assumptions. P4/Monsanto's assumptions appear to be as follows:

- 1) The data may be distributed in a relatively skewed distribution such as an exponential distribution.
- 2) A single value should be considered as an estimate of the mean.
- 3) The percentages of exceedances of the groundwater compliance threshold value 1 should be restricted to 5% (by equating the estimated 95 percentile of the selenium concentrations to 0.05 mg/L).

We generally concur with the first and third assumptions. Choosing the exponential distribution and setting the 95<sup>th</sup> percentile of the selenium concentration at 0.05 mg/L does provide a relatively conservative basis.

For the second assumption, however, the A/T do not believe that treating an individual concentration as an estimate of the mean is the best representation of that information. Instead, a DELB should be selected based on the calculated probability that individual measured concentrations would fall below a threshold concentration. In Table 1, this relationship is shown for various concentrations for a distribution with the estimated 95<sup>th</sup> percentile of selenium values of 0.05 mg/L. From this table, for instance, it can be seen that, for the expected mean value of 0.017, 63.9% of individual values are expected to be at or below 0.017. Note that a value approximately midway between 0.011 mg/L and 0.012 mg/L would serve as an estimate of the 50<sup>th</sup> percentile (median) of the population.

**TABLE 1**  
**Exponential Distribution with a 95<sup>th</sup> Percentile of 0.05 mg/L**

<b>Concentration (mg/L)</b>	<b>Proportion of Individual Concentrations Expected to be Less Than or Equal to the Concentration</b>
0.005	0.259
0.006	0.302
0.007	0.343
0.008	0.381
0.009	0.417
0.010	0.451
0.011	0.483
0.012	0.513
0.013	0.542
0.014	0.568
0.015	0.593
0.016	0.617
0.017	0.639
0.018	0.660
0.019	0.680
0.020	0.699
0.021	0.716
0.022	0.733
0.023	0.748
0.024	0.763
0.025	0.777
0.050	0.950

Based on the preceding discussion, it is apparent that the statistical calculation of the DELB can yield a great range of threshold concentrations depending on professional judgment and the assumptions made. Therefore, please revise and document DQO Step 6 consistent with the preceding comments. At a minimum, revisions to Step 6 should include the following:

- Select a DELB value based on the proportion of concentrations expected to fall at or below some given level where the given level will have to be based on best professional judgment and as approved by the A/T. The A/T view this as an improved interpretation of the statistics rather than referring to a single value as an estimate of the mean, since a single value is a relatively poor estimate of the mean.

Response: *The DELB proposed, a selenium concentration of 0.017 mg/L, is based on an objective statistical method and the confidence level typical used of 95%. We hope the following explanation will provide the agencies with sufficient comfort to approve the proposal; otherwise, we look to the agencies to propose an alternative.*

- Revise or delete presumptions of "confidence" in Step 6, as reflected in the statement "we can be 95% confident that the boring in question does not have problematic levels of

*selenium.*" We believe this is too strong a statement because of the judgment required to define the assumptions, which then plays a huge part in which level is recommended as the DELB. For example, the proposed DELB would have been substantially lower if P4/Monsanto had considered a more conservative distribution, such as one based on an estimated 99<sup>th</sup> percentile set at 0.05 mg/L. In this case, the estimated mean of the population would drop from 0.017 mg/L to 0.007 mg/L. For the expected mean value of 0.007 mg/L, an expected proportion of 63.2% of individual values would be at or below 0.007 mg/L and a value of approximately 0.005 mg/L would serve as an estimate of the 50<sup>th</sup> percentile (median) of the population.

*Response: The statement of confidence is valid for the assumptions provided, and, as the agencies have noted, is conservative. We acknowledge that using a higher level of confidence, e.g., 99 percentile, would be even more conservative, but that is true of any statistical method. If the agencies are requesting the use of 99<sup>th</sup> percentile, we request a rationale for foregoing the more typical 95%.*

*The mean of an exponential distribution is located at the 63.2<sup>nd</sup> percentile of that distribution. An exponential distribution is positively skewed, so the mean is always greater than the median. We can understand that a single random sample can be regarded either as an estimate of the mean or an estimate of the median, and that opting to regard it as an estimate of the median is more conservative in terms of defining a DELB, but statistics, as discussed below, suggest that it is prudent to regard a single random sample as an estimate of the mean.*

*The distribution used is defined solely by our knowledge constraints. As a reminder, these are:*

- *a single value assumed to be an estimate of the mean (or the median or any other quantile – this won't change the form of the distribution); and,*
- *a lower bound of zero.*

*The resulting maximum entropy solution is an exponential distribution. A maximum entropy solution is the most uncertain distribution (where uncertainty is measured by informational entropy) that satisfies the knowledge constraints. For example, if we had two random values, we can estimate a mean and a variance; the lower bound is still zero; thus, the maximum entropy solution would be a 2-parameter lognormal distribution. However, we only have one value, and statistics tells us the best use of that value is to regard it as an estimate of the mean as discuss below.*

*The statistical analysis that tells us it is wise to regard our single value as an estimate of the mean is a simulation wherein 1,000 exponential distributions with a mean of 0.017 are defined. The lone defining parameter of an exponential distribution is usually called the rate, which is the inverse of the mean. For our distribution, where the desired 95<sup>th</sup> percentile is 0.050, the mean is  $0.050/3 = 0.017$ , and  $1/0.017 = 60$ . Now with 1,000 such distributions, we conduct a 1-trial Monte Carlo simulation allowing the computer to select a random value for each of the 1,000 distributions. We see the mean of these 1,000 samples of  $n = 1$  is 0.0167, and the median of these 1,000 samples of  $n = 1$  is 0.0116 – both just as we expect them to be. Which is better? We can decide by calculating the sum of squares for each estimate. The one with the lower sum of squares (less error), is the better statistic with which to label our single*

value. The sum of squares for the mean is defined as the difference between each of the 1,000 samples of  $n = 1$  and the mean, that differences squared, then all 1,000 squared differences added together. For the sum of squares for the median, the same thing is done except using the median instead of the mean. For an example single-trial simulation the sum of squares for the mean of 0.279; whereas, for the median it is 0.309. Thus, this suggests that it is more prudent to regard a single value as an estimate of the mean rather than an estimate of the median, because there is less error associated with taking the position that is an estimate of the mean.

One might ask, will the sum of squares of the mean always be less than the sum of squares of the median? To answer this we used a 10,000-trial simulation and look at the resulting distribution of  $SS_{\text{mean}} - SS_{\text{median}}$ . The result is a distribution with a mean of -0.026, meaning, on average, the mean is the wiser assumption. In fact, not once in 10,000 trials was a positive difference found – the mean appears to be always the wiser assumption.

- Provide sufficient justification for a 95" percentile concentration set at 0.05 mg/L versus a more conservative value such as the 99" or 99.9" percentile.

It is important to emphasize that the intent of the preceding discussion should not be interpreted as a rejection of a DELB value of 0.017 mg/L. The expected mean of 0.017 mg/L may be appropriate. Instead the A/T are saying that the DELB must be based on a more appropriate statistical analysis, as described above. We also want to emphasize that use of a DELB is only one of several factors that must be considered when making decisions on drilling additional wells. In some cases, for instance, additional DP locations may prove necessary to define a plume in an area where other factors, such as natural background conditions, spatial coverage, and proximity to a source, property boundary, or surface waterbody, become key factors in making decisions.

**Response:** *P4/Monsanto's choice of a confidence level of 95% is merely the use of the scientific norm. We believe this is adequate. If the agencies opt for a higher level of confidence, we request a directive and rationale to use another value.*

*P4/Monsanto believes the above has shown that setting the DELB at 0.017 mg Se/L is appropriate given our assumptions and specified level of confidence. If needed, additional information to support our presentation above can be provided. A web conference could be used to show the simulation results, or a complete simulation report can be submitted if requested. We understand that the DELB will not be the only factor used in deciding where to install additional borings or wells. The data need to be mapped and viewed in their entirety before such decisions are made and the extent of contamination defined. The DQOs process does, however, require that tolerances on decision errors be addressed and we believe the DELB, as we've proposed helps satisfy that requirement. However, the A/T and P4/Monsanto have both stated other factors and professional judgment have to be considered when deciding whether or not the extent of a selenium plume has been adequately characterized. As an example, a concentration of 0.017 mg Se/L on a leading edge of a plume may be regarded differently than the same concentration on the upgradient edge. The action taken would need to consider the hydrogeologic component at a minimum.*

*Given the discussions above, the assumption of mean and the 95% confidence level seem reasonable, especially since the number will be used more like a guideline and will not be used in the absence of other information. Even though we have provided specifications for tolerances on decision for this effort, as required by EPA guidance and the consent order, we acknowledge that the results are more meaningful as a 2-dimensional pattern over the study area than they are as individual results, and that such spatial pattern needs to be harmonized with the team's understanding of the alluvial hydrogeology. Quite frankly, the DELB has played, to date, no role in determining where additional boreholes need to be installed, and we will be surprised if it ever plays a significant role. However, we have presented the required specifications that can be called upon in advising the team, in conjunction with all other relevant information, should the need arise.*

1-9. Section 4.0, page 7, Table 1. Label the columns.

Response: *The column labels have been added.*

### ***Editorial Comments***

General: Be consistent, use direct push or direct-push, but not both.

Section 2.0, page 2, paragraph 2, line 7. Change *need* to needed.

Section 3.1, page 4, Step 6, bullet 2, line 8. Delete *need*.

Section 5.1, page 8, number 3. Would you be better off saying (e.g., 158) rather than (*i.e.*, 143) considering that based on Table 1 the last borehole at this time is BH158?

Section 5.1, page 8, paragraph 2, line 3. This should be BallardE-GW400 rather than *BallardE-GW300*, if blind duplicate and rinsate sample numbers start at 400.

Response: *The editorial corrections have been made.*

**JUNE 4, 2009 E-MAIL FROM MIKE ROWE TO CARY FOULK AND BARRY KOCH  
ADDRESSING THE DELB VALUE**

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**From:** Michael.Rowe@deq.idaho.gov  
**Sent:** Thursday, June 04, 2009 10:53 AM  
**To:** Cary Foulk; barry.s.koch@monsanto.com  
**Cc:** aruberry@idl.idaho.gov; William Wright III;  
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sandi\_arena@fws.gov; Tim.Mosko@CH2M.com  
**Subject:** RE: P4/Monsanto - A/T Comments to Direct Push Groundwater  
Continuation Sampling and Analysis Plan, Revision 1

Cary,

The Agencies and Tribes are not completely comfortable with the underlying statistical basis for the proposed decision error lower bound value. We propose the following language as a way to move past this issue.

**Step 6 - Specify Performance or Acceptance Criteria**

•Given that the project goals include generally defining the nature and extent of contamination, including the determination of the extent of groundwater impacts based on the groundwater selenium standard of 0.05 mg/L, and considering the uncertainty associated with instantaneous direct-push reconnaissance groundwater sampling methods, it will be useful to establish a protective lower bound above which the groundwater may be considered potentially impacted in relation to the groundwater standard. In consultation with the Agencies and Tribes, a decision error lower bound (DELB) of one-third the selenium groundwater standard, 0.017 mg/L, was chosen. This DELB value appears to provide a conservative threshold for deciding on whether to continue stepping out to define nature and extent of contamination, and in locations where concentrations are found to be less the DELB, there is a reasonable confidence that the standard is not being exceeded at that location at that time. Such decisions may be based on the DELB, as well as professional judgment, given the hydrogeologic conditions and observed variability in other groundwater samples collected over time at other groundwater monitoring locations at the P4/Monsanto mines.

If the above is acceptable to you, please incorporate into the revision of the *Direct Push Groundwater Continuation Sampling and Analysis Plan*. Please let me know if you have any questions.

Mike

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**From:** Cary Foulk [mailto:Cary.Foulk@us.mwhglobal.com]  
**Sent:** Friday, May 22, 2009 12:23 PM  
**To:** Michael Rowe; barry.s.koch@monsanto.com  
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**Subject:** RE: P4/Monsanto - A/T Comments to Direct Push Groundwater Continuation Sampling and Analysis Plan, Revision 1

Mike,

Please find attached our draft response to the comments that were included in the conditional approval of the Direct Push SAP. Before we submit the next revision of the SAP, we would like to have agreement on our response to the comments related to the DELB value. We have clarified the basis for the DELB, and we hope our clarification gives the agencies and tribes sufficient information to accept the value.

We have agreed that the DELB is not the only criterion for determining if the nature and extent of the alluvial plumes have been characterized. At a minimum, hydrogeologic factors also need to be considered. Therefore, we see no need to further develop the number.

Regards,

Cary

**From:** Michael.Rowe@deq.idaho.gov [mailto:Michael.Rowe@deq.idaho.gov]  
**Sent:** Tuesday, May 12, 2009 9:17 AM  
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**Subject:** P4/Monsanto - A/T Comments to Direct Push Groundwater Continuation Sampling and Analysis Plan, Revision 1

Barry,

Attached are the Agency/Tribal comments for Revision 1 of the *Direct Push Groundwater Continuation Sampling and Analysis Plan*. We have already conditionally approved the Direct Push SAP so work could begin this week. Incorporation of the A/T comments in the attached will result in final approval of the document. A hardcopy will follow.

Mike

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